THE
ELECTRICAL REVIEW.

VOL. LXIII. SEPTEMBER 25, 1908. No. 1,609.

ELECTRICAL REVIEW

Vol. LXIII.] CONTENTS: September 25, 1908. [No. 1,609.

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THE ELECTRICAL REVIEW.

Published every FRIDAY Price 4d.

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OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGNEKAY, LONDON." Code, A B C.

Telephone Nos. Holborn 933 Central 4425 (Editorial only).

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FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

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THE
UNIVERSAL ELECTRICAL DIRECTORY
(J. A. BERLY'S).

1908 EDITION

H. ALABASTER, GATEHOUSE & CO.,
4, Ludgate Hill, London, E.C.

THE ENGINEERS' STRIKE ENDED.

BY a majority of about 10 per cent., on a total poll of 8,348, the allied Societies of Engineers, Engine Makers and Machine Workers on the North-East Coast have decided at last to accept the employers' conditions. Better terms were rejected by them over seven months ago, when they refused to abide by the terms of settlement agreed upon by Mr. Barnes, their representative and general secretary, and Sir Andrew Noble, who represented the employers. Mr. Barnes was practically refused a hearing when, in March last, he attempted to explain to the men the real facts of the situation, and as a result of the determination of the local sections to go their own way, in defiance of the ruling of headquarters, he resigned his position as general secretary.

This action on the part of the men has probably done more harm to the cause of Trade Unionism generally than is yet fully appreciated. For years the Railway Servants have striven for the recognition of their delegates, the companies, on their part, preferring to deal directly with the men without any intermediary. The railway companies could wish for no better argument with which to resist the men's demands than is afforded by the spectacle of the rank and file of the most powerful Trade Union in the kingdom—a society which is supposed to be a model of all that is best in unionism—stultifying its accredited leaders and absolutely repudiating the terms of agreement provisionally entered into by them. We should have thought that Mr. Barnes had, by years of untiring labour in the cause of the Engineers' Society, shown that he had the best interests of the men at heart, and that they would have given him their unswerving and whole-hearted support. The result of the strike shows how accurately he had estimated the men's chances of success in their ill-timed dispute with the employers.

Although the masters' terms will be accepted as a result of the ballot, we are not at all sanguine that the labour war is yet over. In February last there was a majority of 663 on a poll of 8,000 against the terms of settlement; that is to say, about 4,332 were in favour of a strike. The result of the ballot declared last Monday shows that there are still 3,739 against terminating the struggle, so that only about 600 of the malcontents have been converted.

It is interesting to notice also that whilst the majority in favour of accepting the masters' proposals is a bare 10 per cent. of the total poll, the voting of the Amalgamated Society of Engineers shows a majority in favour of settlement of less than 5 per cent., viz., a majority of only 340 on a poll of 6,896. The total percentage is brought up to 10 per cent. by the other two allied societies, whose aggregate numbers, however, are comparatively few, about 1,450 all told. It is clear, however, that a change-over of about 600 members will be sufficient again to reverse the majority.

For the present, however, there is to be peace after nearly eight months of war, a new record in industrial warfare,

which, in these days of record-breaking and the glorification of sport, may appeal to the sporting instincts of the Newcastle working classes. But has the game been worth the candle? For, apart from the incalculable loss to the engineering and allied trades, the game has cost the workmen a pretty penny. It has been estimated by the *Times* that the loss in wages alone is nearly half-a-million sterling. This is based on an average wage of 36s. per week per man, the standard union rate. We can hardly reckon on this as an average all-round figure, because many of the strikers are youths just out of their time, who are not yet entitled to full pay, but who, we understand, have equal voting power with veterans who have regularly contributed to the funds of the Society for the best part of their lives. This has a rather important bearing on the matter, for we were recently assured by a prominent official of one of the leading engineering firms on Tyneside that these young bloods of the Society actually receive more as strike pay than they would earn as wages.

Obviously it suits them to prolong the strike; they have everything to gain by it, and, having subscribed practically nothing to the accumulated funds, have nothing to lose. The older men who have wives and families depending upon them are, perhaps, not so pleased that the strike has lasted so long. There are some among the older men who look upon a strike as a chance to get some of their own back, and others, again, who have two or three sons just out of their time, not yet entitled to full pay, who can well afford to live indefinitely on strike pay. A perusal of the accounts of the A.S.E. shows that more money is disbursed as strike pay than is devoted to sick or benefit purposes. This means that the society is now essentially a fighting society rather than a benefit society, and is, therefore, a constant menace to the engineering industry.

If we are correctly informed, and we have no reason to suppose otherwise, it would appear to be highly desirable that no young member of the society who is not entitled to the full rate of pay, should have equal voting power with older men who have much more at stake. A class of Associate-Membership with limited voting powers might be formed, and qualification for full membership should be, say, five years' work as a journeyman. If a body of 600 young artisans recruited from the ranks of the apprentices can turn the scale of a ballot among 8,000 voters, and can thus involve the trade in disastrous strikes extending over six months—and it would have lasted longer but for the threat of the masters to bring the whole of the allied trades out—it is hopeless to look for a lasting peace or a settled condition of affairs in the engineering trades. We will not dilate on the effect of strikes on the industry of the country. It does not appeal in the least to the working classes and is well known to the employers.

But what has the fight been about? A reduction of 1s. per week per man. But the loss of wages in the meantime, reckoning on an average of only 25s. per week, for 30 weeks, was £300,000. It is stated that the average strike pay has been £1 per week per man; so in 30 weeks £240,000 of hard-earned savings have been squandered! Perhaps the average workman does not appreciate what this means. It means that an amount has been withdrawn from the accumulated capital, which at 5 per cent. interest would bring in *£12,000 per annum*. A great deal can be done with £12,000 per annum. Think of it—£12,000 per annum thrown away by 8,000 men at the bidding of a majority of 663!

LORD ROSEBERY AND TECHNICAL EDUCATION.

An interesting and important ceremony took place at Edinburgh on Wednesday, September 16th, when the new engineering laboratories of the Heriot-Watt College were formally opened by Lord Rosebery. As is his wont, his Lordship took advantage of the occasion to deliver one of those suggestive addresses which we have become accustomed to expect from him. The history of the College, marked by a steady widening of activities and increasing breadth of teaching, is itself inspiring. Founded in 1821 with the object of giving evening instruction to artisans, the institution must be regarded as the parent of all the mechanics' institutes and polytechnics throughout the country. In 1851 it purchased new premises with a fund raised in memory of the great engineer, James Watt, and became the Watt Institution. In 1873 it moved into more commodious buildings on the site of the present college, and finally by amalgamation with the Heriot Trust blossomed, in 1885, into the Heriot-Watt College. Teaching at first only the elements of sciences obviously capable of direct practical application to the trades of Edinburgh, it has gradually risen to the rank of a first-class technical college. During the day it does the work which is done by the polytechnics of Germany, but unlike these it works in close conjunction with its neighbour, the University; its evening classes correspond to the trade and commercial schools.

Lord Rosebery is greatly impressed by the magnificent sight afforded by the contemplation of the thousands of students who utilise the College. To share whole-heartedly in his Lordship's enthusiasm we must unfortunately confine ourselves strictly to the counting of noses. We do not believe for a moment that the authorities of the Heriot-Watt College measure the success of their institution in such a manner; Scotland has too long been accustomed to high ideals in education, and as a good Scot Lord Rosebery himself has his doubts on the matter, for earlier in his speech he laid stress on the necessity of increasing the number of day students if the institution is ever to reach its full development. Last session the College had 3,276 students on its roll—a goodly number—but of these only 236 attended day classes, whilst the remaining 3,040 were enrolled in the evening school. This relation between the numbers of the day and evening students is typical of the state of things in our technical schools and colleges all over the country. Is such a state of things satisfactory? Far be it from us to do otherwise than sympathise with, and admire those who, after the labour of the day and at the expense of further toil, endeavour to increase their value as individuals, or strive after that culture which comes only

with deepening knowledge and increasing breadth of view. All must agree "that there is no more encouraging symptom in any community than this," and that youth "determined and resolute on its own perfection and its own efficiency is the surest sign of the health and strength of a country," but we are left to lament that such enterprise and perseverance should be to a great extent frustrated for want of better opportunity. For let us face the fact, that the business of a technical college is to train specialists, and that it is the day student who is capable of being trained, and who, therefore, is of first importance. Under what tremendous disabilities does the evening student follow his pursuit of knowledge! Commonly he has left school at an all too early age to plunge into the industrial struggle for existence, and there has ensued an educational interregnum, so that when, after many months, perchance after many years, comes the stimulus to build further, the foundations—weak at the best—are already undergoing disintegration. Add that he arrives at the classroom with tired body and brain—the evening teacher, in his moments of expansion, will bear witness how often, with compassion in his heart, he has refrained from disturbing a slumbering student—and we must be more amazed at the force expended than expectant of any great results. The day student, on the other hand, is, as a rule, better equipped in the matter of his secondary education, and gives the freshness of body and brain, as well as more of the necessary time, to the work of training.

Like many speakers in recent years, Lord Rosebery drew attention to the large number of trained specialists employed by German commercial firms, and suggested that the employers of Great Britain should seriously consider whether it might not be worth their while to utilise more the services of such men; if they "take a page out of the German book, why, there is a sphere of usefulness for this college, the importance of which we cannot over-rate in training such specialists for the need of a commercial country." Therein lies the crux of the student question; the would-be student naturally must pause to ask what chance there is of employment for him when trained, and the answer lies with the employers of the country. The supply in this case is regulated almost entirely by the demand; just as soon as the prospect of employment for the trained specialist improves, so soon may we expect to see an increased number of day students in our technical colleges.

Lord Rosebery made a very practical suggestion as to the utilisation of the college. "If it were found possible for employers to give their apprentices days for study here besides the evenings their apprentices furnish for themselves, surely both the students and the employer would find their reward." The excellence of this suggestion is in no way impaired by the fact the plan has already recommended itself to employers in other towns. In January, 1906, Prof. Ripper, addressing the Association of Technical Institutions, said: "Attendance at the works and college concurrently is (a method) approved in the Glasgow district of Scotland, and by such distinguished firms as Messrs. Vickers, Sons and Maxim, and Messrs. Yarrow. I have had some three years' experience of this system, and I am satisfied that it is a very good one." This system will probably be found to work most successfully when the student has already a sound training in general science before entering the works. It is certainly a system worth a much more extended trial than it has yet obtained. The Heriot-Watt College with its new equipment of engineering laboratories offers an excellent opportunity for experiment in these directions by the local electrical and engineering firms.

The India-Rubber Exhibition at Olympia.

Considering the importance of india-rubber to the electrical engineer, it is surprising how little knowledge of it is common property. Every engineer ought to have seen the Exhibition at Olympia. It was not so much a show of manufactured rubber nor yet of the machinery employed in manufacture, but rather a rubber cultivators' or collectors' show. Raw rubber was in evidence in many very different states of black, ribbon, scrap, biscuit and crêpe, for the latter is one of the forms into which the crude gum is reduced by cleaning and rolling between fluted rolls in the process of preparing rubber for delivery from the plantations.

In spite of all the talk of rubber planting for some years past, very little cultivated rubber has so far been placed on the market. Indeed, the proportion is less than 3 per cent. But this does not mean so little as it appears, for it requires six or seven years for a planted tree to arrive at productive age, and in a few years from now there will be a very rapid rise in the production of cultivated rubber from trees planted three, four and five years ago; others will follow, and though the waiting is weary there does seem to be a reasonable and sure prospect of a lively demand for rubber in the future. What is of special interest on political grounds is the suitability of so much of the British Empire for rubber cultivation. No longer need so many of our colonists lament their too prolonged reliance on sugar. Ceylon once mourned over coffee, when its rival tea was found more than able to take its place, and similarly cocoa is so far supplanting sugar that the great future of rubber has not been sufficiently appreciated in say, the West Indies, where rubber will grow well in many of the islands, notably Trinidad, Dominica, and St. Lucia. Other colonies produce rubber, notably Ceylon, the Gold Coast, East Africa, and the Malay peninsula, and it is grown in Travancore also. The planted tree appears usually to be the Hevea braziliensis, the source of the well-known Para rubber of South America, which derives its name from the port whence it so largely comes. But there are quite a number of trees which yield rubber, as well as trees which yield inferior juices that are used as adulterants of the true latex, and bring some of the Gold Coast product into bad repute by producing fermentation. With Para rubber there is no fermentation, for the fresh rubber is smoked, as it is coagulated on a wooden paddle, over burning nuts, and the creosote fumes in the smoke cure the rubber, which will last unimpaired for years. It has perhaps not yet been shown that cultivated rubber is quite equal in quality to the native product of the forest. But it comes to market very clean and nicely prepared, and even the owners of native forests are planting rubber trees, so as not to be behind the times. With more rubber in the market, we may even hope to see it cheaper, for at present much rubber is more mineral than vegetable—more loading than carrying vehicle.

A Hackney Lamp Contract.—With reference to a complaint that the General Electric Co. had not supplied satisfactory flame arc lamps in accordance with contract, the Electric Lighting Committee of the Borough Council has now reported that the company has replaced all the faulty lamps. The Committee has communicated with the company in reference to damages for the delay in completion.

D

THE CREED TELEGRAPH PRINTER.

This instrument completes the Creed printing telegraph system, in which the message is first treated by an operator at the Creed keyboard perforator producing a paper tape with perforations representing the message in the Morse code.

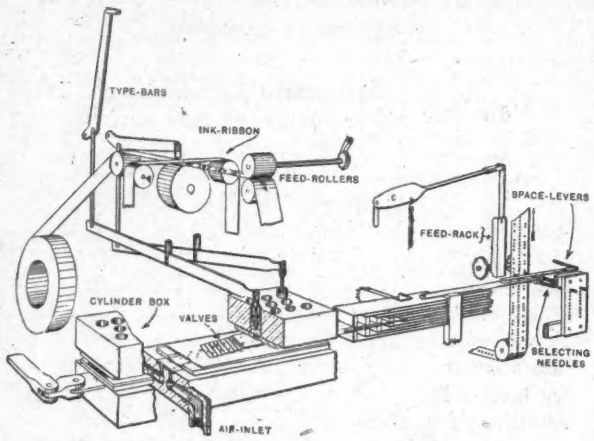

Fig. 1.—Diagram showing Action of Printer.

This tape is identical with the Wheatstone perforated tape, and is passed through a Wheatstone transmitter, which sends to line the desired long and short currents. At the other end of the line the received signals actuate the Creed receiving perforator (see Electrical Review, June 14th, 1907) which reproduces an exact copy of the transmitting slip. This received slip is then passed through the Creed printer, reproducing the message in Roman characters on a paper tape, which is then pasted to a telegraph form. The received perforated tape can be run through the printer several times, and, in addition, can be utilised to re-transmit the signals to any other line equipped with Wheatstone apparatus.

A diagrammatic explanation of the action of the printer is given in fig. 1, and a view of the complete machine in fig. 2.

The received perforated slip is passed into the machine at A (fig. 1) and out at B; while the slip on which the printing takes place is drawn by a pair of feed-rollers from the roll on the upper left-hand side, between the connecting rods of the type-bars and over the printing platen.

The perforated tape is fed forward letter by letter in a guide-way in front of a series of ten pairs of selecting needles, one needle of each pair being mechanically connected to a series of ten slide-valve plates. Each of these valve plates can be made to occupy one of two positions, thus providing a number of different combinations, every one of which opens one complete and particular passage through the ten slide-valve plates. Air under pressure can thus be admitted to any one of a number of small cylinders, each containing a piston acting on the end of a lever connected to a type bar.

The perforated slip is fed forward by a star wheel fitted to a spindle carrying a toothed wheel, which is rotated as required by the movement of a rack. The rack is given a vertical motion for feeding purposes, and a sidewise motion for acting on any slide valves that may have been selected. Its movement is obtained from the cam-shaft of the machine, which is belt-driven from a small electric motor. The extent of the vertical movement is limited by the distance to the first space signal, that is to say, the length of a letter. To provide for this limit there is a group of ten space levers normally in the path of the rack, and preventing its downward movement. Each space-lever is also in the path of one pair of selecting needles, and when either needle of a pair passes through a perforation, that particular space lever is moved out of the path of the rack. Hence, with any letter or figure of the International Morse code there is a clear downward path for the feed-rack until it reaches a space signal. A sidewise movement is then given to the rack, putting it in gear with the toothed wheel. Next, the rack is given an upward motion, causing the toothed-wheel to turn and the perforated tape to be fed upward by the amount of the particular letter that has just passed. The rack is then moved sidewise again, clear of the toothed wheel, ready to descend as far as the next space signal.

The slide valves made of thin sheet-steel have each a hinged extension whose further end is arranged to take up the movement of the corresponding selecting needle in its motion to and from the perforated tape. At the same time, the extension is free to move in a direction at right-angles to the needle. Each valve-extension is provided with a shoulder which comes into the sidewise path of the feed rack when that particular extension has been selected. At the correct moment, determined by the position of a cam on the main spindle, the rack is moved sidewise, and engaging with the shoulders of the valve extensions which have been selected, moves the corresponding slide-valves into their second position. Another cam opens a main valve, admitting air under pressure to the slide-valve chamber, whence it passes through the ten valve plates by the one hole available in that particular setting of the valves, forces up the particular piston and prints the corresponding letter. Another main valve is then opened to allow the air to escape, and the selected slide valves are returned to their normal position.

Although more than the required number of selecting needles for any particular letter may pass through the tape, only the proper number of slide valves are acted upon by the rack, on account of the spacing lever preventing the rack descending beyond the required amount.

It will be observed that there are 20 selecting needles, but only the 10 acting on the lower row of holes in the perforated slip are attached to valves; the other row of needles is not necessary for selecting purposes, but is required for shifting the spacing levers for the first portion of a dash signal.

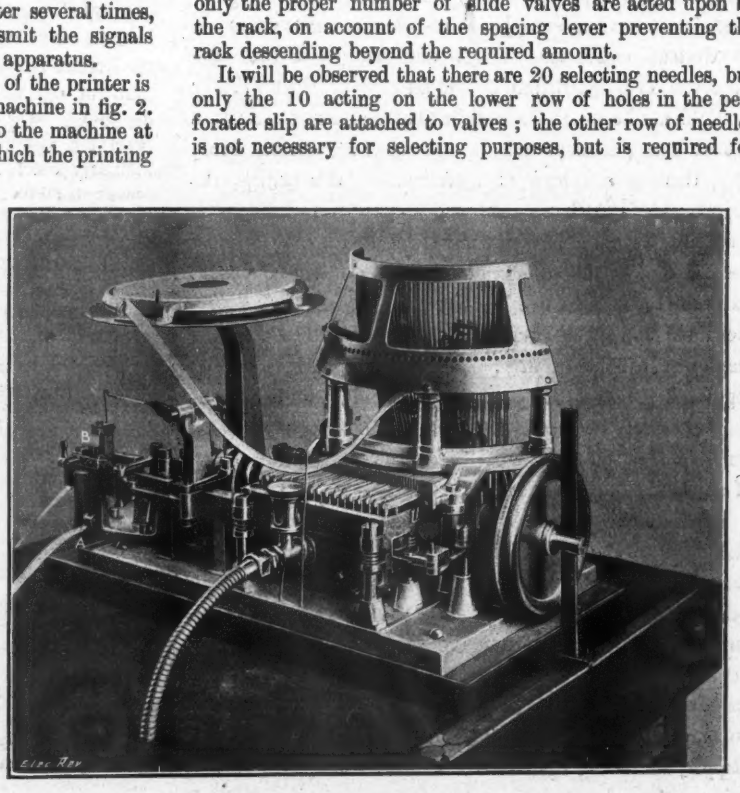

Fig. 2.—Creed Telegraph Printer.

The machine prints satisfactorily at any speed up to 125 words per minute; but this is not the maximum, it being considered possible to reach 150 with the present form of machine, and this will probably be increased with improvements in details.

The chief claim for this system of telegraph printing is the undoubted advantage obtained by using the well-known Morse code, entailing no alteration of existing telegraphic apparatus nor need for operators to learn a new code. Intermediate stations, such as repeater stations or testing points, can check the passage of the signals without any knowledge of the Creed system, and can make all necessary adjustments without reference to the terminal stations. The system, being an addition to the Wheatstone system, can be introduced gradually without disarranging any of the present Morse methods.

THE BRITISH ASSOCIATION MEETING AT DUBLIN.

The Utilisation of Peat.

By Capt. H. Riall Sankey, R.E. (ret.), M.Inst.C.E.

Read in Section G, September 7th, 1908.

The following abstract of the paper will be sufficient for our purpose, and we will consider it in the light of other information at the end :—

Many schemes for the utilisation of peat for fuel have been devised, but, generally speaking, all have failed, the reason being that all have endeavoured to dry the peat down to a small percentage of water contents in order to use it under boilers in the same manner as coal. The expense of the getting, drying, preparation and carriage have been prohibitive, and the method of use itself destroyed the by-products available.

All modern schemes of any value are based on the gasifying of the peat in a much better condition, and in such a manner that certain by-products are obtained, which, when sold, are set off against the cost of the fuel.

Gas, suitable for engines, can be made from 60 per cent. peat (*i.e.*, peat containing 60 per cent. of water by weight). When got from the bog peat contains from 85 per cent. to 90 per cent. of water, which is soon reduced to 60 per cent. by air drying.

In Sweden there are many small installations in which peat is used as a fuel for the production of electricity through gas engines and dynamos, but there is at present no large undertaking conceived on the economical lines indicated above, although each of the separate operations essential to such an installation are already at work successfully, and all that remains is to combine them.

At Aurich, Germany, peat is burned under steam boilers to supply a 5,000-kw. station, but it appears that the cost of the fuel is equivalent to coal at 5s. to 6s. per ton, which is not nearly so low as the figure aimed in the gas-producer scheme.

Peat may be got in four ways :—

1. Entirely by hand labour, as in Ireland, and in other countries where it is used for domestic purposes. This, of course, is out of the question, and the peat can only be "harvested" like other crops during a portion of the year. The cost, reckoned on anhydrous—*i.e.*, chemically dry—peat appears to be about 6s. per ton at the producer.

2. The peat may be cut by hand and then transported mechanically to a power-driven press (Dornberg or Anrep processes), in which it is broken up, and to some extent compressed. It is then cut into slabs which are laid out to dry. It is estimated that in Ireland the cost of this process would be about 4s. per ton.

3. The peat can be dug mechanically (Streuge's system), and discharged from the "navvy" on to a conveyor which carries it to presses as before. Then, in the form of peat mud it is conveyed mechanically again to a spreading arrangement laid out on the bog. Here it lies to a depth of 9 in. in a continuous cake about 60 yds. wide. In this state it can only dry on the surface, so it is cut into sods by a combination of mechanical and hand power. This process cannot be worked in water, and the peat as dug must not contain less than 90 per cent. of water, otherwise the mud will not pass the conveyors. These considerations limit the utility of the machine.

4. The peat can be dug by a grab mounted on a truck on rails, or on a barge floating in the dug-out part of the bog. The peat is loaded into tip wagons and taken to a press, whence the mud is conveyed to a spreading ground, and is opened to a depth of about 4 in.

Horse or mechanically drawn rakes score grooves in this peat cake, and in a few days the scores open into cracks and transverse cracks are also formed by contraction from drying. The sods are stacked, and shortly the moisture is reduced to 60 per cent. In Ireland the cost of this process should be reduced to about 3s. per ton, provided that the hygrometric conditions are such as to make the scored peat-cake crack up into sods.

Taking everything into consideration, it seems that the last process is the best for the purpose of the power scheme, as it can be worked in all weathers except hard frost, and the peat can be dug under water.

When cut and stacked, peat will dry to 60 per cent. in a few days in summer weather, but in spring and autumn longer is required, and in winter it may not dry at all.

By pressing, the peat water is brought to the surface, and drying is more rapid, and the effect of the Dornberg press is to put a kind of skin on the sods which makes them water-tight.

Mr. A. B. Lennox dries peat on a moor near Dumfries, by placing the cut sods on wooden trays with short legs, so that the trays can be packed in tiers. This method facilitates drying by drainage and complete exposure to the air.

Dr. Ekenberg has devised a scheme for drying peat for making briquettes, which has distinctive features. He states that when 90 per cent. peat is heated to over 150° C. (300° F.) the shiny hydro-cellulose, which retards the extraction of water even under hydraulic pressure, is decomposed, and at the same time the peat is partially carbonised, whereupon it can be dried to 35 per cent. For use in producers the briquetting process is not required, and Dr. Ekenberg states that in less than an hour 90 per cent. peat can be reduced to 60 per cent. for a cost of 3s. per ton of anhydrous peat, with all the by-products intact. To do this, about a third of the peat has to be burned to provide the necessary heat, but there appears to be no reason why the waste gas, which would be produced in the proposed power scheme during the hours of light load, should not be utilised for this purpose, instead of burning it to waste.

The percentage of the original water in the peat, which must be removed in order to increase the dryness from p to q per cent. of water is given by the following expression—

$$10{,}000\ \frac{p-q}{p(100-q)},$$

and it is to be observed that the percentage of original water removed is not proportional to the difficulty and time required in removing it, which increases rapidly as the peat becomes drier.

The drying is the crux of the whole situation, and it has special importance in Ireland owing to the damp climate. German experience, therefore, cannot be applied to Ireland without modification, and difficulty will be caused in the latter country by the continued dampness of the air, practically all the year round.

The top layers of peat, which are not so suitable as the lower layers for gas production, can be converted into "peat mull," for packing fruit, preserving eggs, feeding cattle, and for litter.

Two analyses of peat-produced gas are given, the first from Messrs. Körting, and the second by Mr. Rigby (Crossley Bros.). Both are without by-products.

	I.	II.
CO	15	12
H	10	24
CH_4	4	2·8
CO_2	14	18
N	57	43·2
	100	100

The lower calorific value of these gases were I. 118 B.Th.U. per cb. ft., II 135·7 B.Th.U. The by-products which can be obtained from peat are numerous, but at the moment, when gas is being made, sulphate of ammonia is the only one which has been treated on commercial lines, and it is estimated that when combined with a power scheme, the net profit on this commodity is about 4s. per ton. Probably other products will be obtained on a commercial scale at a later date.

Theoretically, the maximum yield of sulphate is $1\frac{1}{3}\frac{3}{3}$ times the nitrogen present, but according to Messrs. Crossley's trials the actual yield with peat containing 2·2 per cent. N, was 140 lb. per ton of anhydrous peat, which is 60 per cent. of the theoretical yield.

With regard to the gas engines, there is very little saving in capital cost and none in annual cost in using very large units.

To determine the cost of fuel per kilowatt-hour it must be stated that the calorific value of anhydrous peat is 8,600 B.Th.U., and that the thermal efficiency of a producer may be taken at 75 per cent., and that of a good gas engine, reckoned on B.H.P., as 30 per cent.; therefore, the thermal efficiency of the complete plant is 22·5 per cent., hence from 1 lb. of anhydrous peat 1,935 B.Th.U. will be converted into work, so that 1 B.H.P. will require 2,545/1,935, or 1·32 lb. of *anhydrous peat* per hour. Taking the dynamo efficiency as 90 per cent., the consumption of anhydrous peat per unit is 1·95 lb. At 3s. per ton the cost of fuel per unit = 0·031d. at *full load*. Assuming an average load factor of 70 per cent., the fuel consumption will rise to 2·15 lb. and the cost to 0·034d. per unit.

The author compares these figures favourably with the consumption and cost per unit of gas made from bituminous coal costing 14s. per ton in Dublin, and adds that up to the present the most economical steam-driven station has a fuel cost of 0·20d. per unit, and he draws the conclusion that peat, when used in close proximity to the bog is far more economical as regards fuel cost than any existing steam-driven station (especially, he might have added, when the value of the by-products is credited to the peat), and shows a considerable advantage over any possible producer-gas driven station using coal.

When the by-products are recovered the consumption of peat per unit is increased, and it is estimated, from the Crossley experiments, that 1 ton will produce 1,000 B.H.P. per hour, giving a fuel cost of 0·05d. per unit without crediting the by-products.

An acre of bog 20 ft. deep contains 24,000 tons of 90 per cent. peat, which, on the assumption that 1 ton of anhydrous peat will produce 700 units = 1,680,000 units per acre.

The power produced must be utilised near the bog, and the commercial success of any peat-electric scheme depends on the certain establishment of a handy market for its product.

The author then points out how many processes now exist which demand very cheap power in large quantities, and suggests that

manufacturers will flock to the neighbourhood of the Bog of Allen directly the Central Ireland power scheme materialises.

The paper concludes with an interesting description of the peat works at Beuerberg, near Munich, where peat-coke or charcoal and "semi-peat-coke" are produced under Dr. Ziegler's patents.

This plant is capable of treating 35,000 tons of anhydrous peat per annum, which will produce:—

Peat coke	13,800 tons.
Paraffin	230 "
Oils (heavy and light)	1,380 "
Sulphate of ammonia	184 "
Methol alcohol	92 "
Acetate of lime	270 "

No one who has followed, even cursorily, the recent development of research into the possible ways of utilising this elusive fuel can help being impressed very deeply by the potential importance of the subject. While coal, which can be burned as it is got without trouble, was obtainable in what were supposed, carelessly enough, to be inexhaustible quantities, it was impossible to persuade those who had the means at hand to take a sufficiently abiding interest in the commercial use of a vastly more refractory substitute; but the time has arrived when an increased standard of wages, a decreased tale of working hours, and the disquieting reports of national stock takers, have combined to force the large coal users of the world to pay more attention to every plausible scheme for reducing the cost of power.

To that we owe in large measure the development of huge central power stations, and to that we certainly owe the great improvements in gas producers and gas engines which have been made during the last decade.

In those countries where Nature's pump is at work on a prodigious scale, man has saved coal by using water-power, but in these islands we have to seek other, and less obvious, endowments.

A great proportion of the acreage of Ireland is bog land, and for innumerable centuries the natives have cooked their food and heated their houses by the combustion of peat dug from these bogs. Why, then, should this fuel not be used on the grand scale, and what stops Ireland's poverty from becoming Ireland's wealth? The reply is to be found in Capt. Riall Sankey's paper, and, more poignantly, in the hundred failures which have built up the pessimism regarding the practical value of any scheme at all for the production of a commercial fuel.

There is the peat in immense quantity, for all to see, and there with it is nine-tenths of its weight of fire's enemy.

Until now, and even now, energy and money and brains have been, and are being, directed to the expressing of as much water as possible from the peat. Imagine the task! One acre of bog 20 ft. deep yields 24,000 tons of so-called peat, and all that weight has to be be cut and moved in order to get a paltry 2,400 tons of quite dry fuel. In other words, the efficiency of the first operation is 10 per cent.!

It is as if in a coal mine for every 10 tons of burnable coal 90 tons of rock and rubbish had to be hewn and raised.

Is it conceivable that we shall be content with such an efficiency, even though *it is estimated* that under present conditions the cost of a unit of electricity, peat produced, is lower than the cost of a unit obtained by any other means involving combustion?

We foreshadow a greatly different state of affairs, for we believe that there must be some latent means by which the fuel we want may be got and the non-fuel left, and the task of the searcher thus rendered much more simple since it has been proved that 60 per cent. peat may be fed directly into a gas-producer.

All these pressing, spreading, and briquetting processes would go by the board in such a case, and the whole business would be fined down to getting the peat from the bog to the producer.

Briquetting is necessary only for so long as there is a demand for neat fuel, and as soon as users begin to realise that the same results can be got from a shapeless lump as from the same material in the shape of a brick or a prism, they will refuse to pay for effect. The fact that people who burn peat coke like to have it in the shape to which they have been accustomed since the turf-cutter first used his "slane," provides another interesting example of the survival of form through custom only, and after any real need for the form has passed away.

Dr. Ekenberg's "wet carbonising" process, as he calls it in a pamphlet before us, may be a commercial success for all we know, but the imagination staggers at the quantity of bog which would have to be pumped through water-tube boilers in order to raise the whole mass to over 150° C. For instance, the production of two million units would require the treatment of some 30,000 tons, plus another 10,000 to provide the necessary heat.

But those who are looking forward to the establishment of an Irish central power station need not trouble themselves about processes which dry the peat as the Ekenberg system dries it. What they need is the simplest possible method of salving the bog in large quantities, and of drying it to 60 per cent., or perhaps to 45 per cent., for use in producers.

Here we wish to record our opinion that the enthusiastic and perfectly genuine promoters of the Central Ireland scheme will be doing the best for themselves and for their shareholders, and for Ireland too, if they put their electrical schemes into the background and push, for all they are worth, the production of the valuable by-products which it has been proved can be extracted at a profit. Let them make a success of that business first, and they can by degrees build up an electric supply business which will attract manufacturers to the neighbourhood of the power station. To our mind it would be the grossest folly to reverse the procedure by starting off with the electric end, while the ground is still bare of factories. Promises and probabilities are all very well for a prospectus, but a good motor load, or the large and constant output recovered by electrolytic and electrochemical works are rather better for the payment of cash dividends, and until this large output is realised, it will not be feasible to flourish an all-persuading tariff before manufacturers in search of more margin.

We do not forget that the two businesses are slightly antagonistic, to the extent only that as much power cannot be got from a ton of peat if the by-products are recovered, as when they are not recovered, but that would make no practical difference at that period in the history of the undertaking, when either the chemicals or the electricity cost nothing, or next to nothing, to produce.

As for saddling the scheme at the outset with long transmission lines, which now would lead to cities of the calibre of Enniskerry, proud of its 100 inhabitants, we would have none of it, and would condemn such an attempt in the strongest terms.

We do firmly believe that the art and science of peat getting has even now reached that stage at which, given a good bog, any sound company could make reasonable profits almost as soon as the plant was put down, and that is what we want to see done on the Bog of Allen. If the enterprise of the Central Ireland Co. were successful, the next century would see the face of Ireland changed and her people prosperous.

So mote it be.

THE WEDNESBURY PUZZLE.

A Reply by the Borough Electrical Engineer of Wednesbury.

The "article" in your issue of September 11th, under the above heading, suggests that the Wednesbury Corporation, by taking a supply in bulk from the Midland Co., prevented the company from laying the mains and carrying out their order at the start. This is absolutely untrue, and I have documents to prove that the company gave notice to lay mains in Wednesbury years ago, but that they failed to lay their mains within the period stated in the notice, and within the period specified under their order. The company were pressed to lay their mains by the Town Clerk, long before the Corporation decided, after being practically compelled to do so by the Board of Trade, to carry out its order. The company's order would certainly have been revoked at that time if the Corporation had applied to the Board of Trade, and the only reason why the Corporation did not apply for such revocation was that it was convenient to the Corporation to obtain a

supply in bulk from the company, and it was unfortunately necessary for the company's order to remain in force to enable the company to supply the Corporation in bulk. As the company's order has clearly only been allowed to exist to give the legal power to supply the Wednesbury Corporation, the company are not, I think, justified in laying mains in Wednesbury, seeing that the Corporation has spent a large amount of money to provide a supply which the company had neglected to give. The legal position may be that the company have a right to lay mains in Wednesbury as long as their order exists, and no one disputes this legal right. Everyone in Wednesbury thinks, however, that the company would do better to spend their remaining capital in properly developing the other 68 square miles of their area, where they will find plenty of scope for their capital without spending it on such a hazardous undertaking as competition with a local authority in its own area. However, the Corporation has no wish at the moment to prevent the company from spending money in the town, as it will no doubt provide a good deal of employment for the unemployed labourers, of whom there are, unfortunately, plenty in the Black Country, but no sensible person can doubt for a moment that such expenditure will be unproductive. It is hardly necessary to point out that the private supply in Wednesbury is already very well catered for, and with regard to the works supply, it is fortunate that many of the principal works owners are members of the Wednesbury Council, and that the others are in very close touch with the local governing body. For this reason, and in view of the fact that the Corporation's charges will always be as low as the company's, it is clear that there will always be very few, if any, consumers who, having a financial interest as ratepayers and townsmen in their undertaking, will be foolish enough to buy from an opposition shop. The company must also be aware that they cannot offer specially low charges in Wednesbury in the way of price cutting, without upsetting their customers in the remainder of their 70-square-mile area.

At the commencement of the article there is a suggestion that the company has maintained a dignified and apathetic attitude during the last 12 months, and there is also a suggestion *per contra* that the Corporation has not. This is somewhat amusing, in view of the fact that upon its becoming known that the Corporation was applying to the Local Government Board, the company commenced to beat the big drum, which has not so far produced very good music. The company were undignified enough to oppose the Corporation's application, not openly as an opposition concern, but as "ratepayers." They also condescended to the somewhat unnecessary course of attacking the Corporation's scheme, and, further, flooded the district with canvassers, who tried, without effect, to shake the allegiance of the Corporation's consumers. Such canvassers spread the most absurd reports of the company's intention to cut off the bulk supply, and leave the Corporation "in a hole." The company also commenced a Press campaign both in the local and technical papers, usually in the guise of semi-editorial communications. The last of these is contained in your issue of the 11th inst. Some of my time has been taken up in following and correcting mis-statements contained in these communications, but in no case have I or any official or member of the Wednesbury Corporation written publicly on this subject, except to correct these statements.

We look upon this matter as one which concerns Wednesbury, and Wednesbury alone.

With regard to the comparison of the size of our plant and that of the company's, I beg to point out that our 330-KW. plant, even leaving the battery out of consideration, is larger in comparison to our area than the company's 6,000 KW. is to their much-vaunted 70-square-mile area.

As a further illustration of the attitude of the company, I would mention that we discovered that the bulk supply had been cut off on the evening of the 7th inst.—that is, on the day following our change-over from the two to the three-wire system, at a time when we were likely to be in difficulties. Fortunately, my staff, having previously been compelled to do without the company's supply for periods varying from one minute to two hours, were able to cope with this deliberate disconnection just as well as they have coped with previous involuntary and accidental cessations of the company's supply.

With regard to our gas-engine station, the result is, I know, being followed with much interest by the engineers of several other local authorities of moderate size, taking a bulk supply. If I demonstrate that modern gas engines are in moderate sizes reliable and economical, I have no doubt there will be fewer bulk supply schemes, and this is probably the reason why such strong opposition is being felt by us. It is absurd to speak of bulk supply *v.* separate plant in a general manner, or to form conclusions which would be applicable to all cases; it is merely a question of price and local conditions. If the company offer us terms lower than our working costs, we will certainly use the bulk supply, and keep our gas engines as a stand-by.

With regard to reliability, my experience goes to show that the supply from a large power station, generating at a very high voltage and supplying lighting and traction off the same generators, is not very reliable or steady, from the authorised distributors' point of view. It may be that a modern gas-engine station, with a battery which can take a considerable load for a short period, is more economical and reliable than the available bulk supply. In any case we have tried bulk supply, and it has been found wanting in reliability and economy in this district, where there is a considerable power demand. Time alone can show whether our own plant will be superior in economy and reliability, but at any rate I do ask for a fair field and for a reasonable time for the new system to show its strong and weak points before we are subject to undue criticism. The new plant has only been in operation 10 days.—W. FENNELL.

CORRESPONDENCE.

Letters received by us after 5 P.M. on TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Symbols for Physical Quantities.

Now that there has been some opportunity for discussing this question, may I be permitted to summarise the arguments that have been raised for and against the creation of new symbols?

The most common objection is "They are like Chinese characters; we could never remember them." But there will be no necessity to remember them. How many of us can remember what symbol Rankine uses for kinetic energy? Is it not sufficient if we see it when we refer to his book? Every considerate writer to-day gives a list of the symbols he uses. If all writers used the same symbols, we should soon become familiar with those with which we were most concerned, and for the rest we would refer to the list just as at present.

Some objectors do not see why the letters we have at present are not sufficient. Let them try to make a list of symbols for the 200 physical quantities for which symbols are wanted. After they have made up such a list to satisfy themselves (if such a thing is possible) let them try to convince someone else to adopt it.

There are about 20 letters, such as *m* for "mass," *t* for "time," &c., upon which there is almost universal agreement. One or two dozen more stand a fair chance of being agreed upon. Beyond these, there is hopeless confusion, simply because all the good letters are exhausted.

As to the difficulty of printing new symbols, it is of interest to know that 25 of the leading technical journals of the world published an article containing five new symbols given as examples without any difficulty. Several of them have expressed the view that there is no difficulty from the printers' point of view. The types supplied to them—which, by the way, cost 1d. for 30—were all of one size, and yet each paper used for the text of the article its usual standard type. The publisher of the *Elektrotechnische Zeitschrift* thinks that there would be no difficulty in arranging with a type-founder to make matrices, from which all

printers could be supplied with type. Each printer would keep in stock those types which commonly occurred in his paper, and could obtain others at short notice. About 30 new symbols would be sufficient for articles on electro-technical science.

Two papers have objected that the symbols cannot be set up on a linotype machine. It is, however, usual at the present time to set up mathematical expressions by hand.

Several critics have pointed out that the new symbols should be simple and bold in outline, so that they cannot be easily mistaken for one another. This, of course, is an important point to bear in mind.

I agree with M. Galliot that the name of the symbol should be, where possible, the name of the physical unit represented. Where the name of the unit cannot be employed, a word of one syllable might be chosen, as, for instance, "stroke" for the length of a piston stroke.

Some critics say that the number of symbols required would be too great. As to that, we can make just as many as convenient. The symbol ~ became universal almost as soon as it was printed. Let us have a few more as good as that one; we are badly in need of them.

Miles Walker.

Hale, *September 19th*, 1908.

Are Electrical Engineers Doomed?

Your correspondent, Jos. Pownall, in his letter on the dynamotor causing the doom of the electrical trade, writes as if the dynamotor was the only cause for anxiety amongst electrical engineers. Personally, I have considered the position of an electrical engineer anything but an enviable one for the last year or two.

When we see such advertisements in the "Situations Wanted" column as "Competent engineer, five years' experience," and "Electrician, plumber, &c., wants berth, low wages," is it any wonder that there are so many really first-class electrical engineers out of employment?

We electrical engineers will have no chance whatever while employers will engage anyone who will accept very low wages (and with it poor work) in the hope that the work and man will improve as time goes on, thus cutting out the man who has gone through a proper apprenticeship and training and is competent to accept a good berth and give good work in return.

I give my own experience as an example.

My electrical training cost my parents something like £500 (this includes premium, fees for classes, &c.). I have had a good, sound experience of nine years, starting at the bottom and working up through the whole course, including wiring, repairs to machines and apparatus, bench and lathe work, drawing, &c.

I hold a first-class certificate for (theory) electrical engineering, and have a knowledge of French, and am willing to learn any other language which would enable me to secure a good berth either here or abroad.

The result of this study and expense is—out of employment for two months, and visions of as many years to come—and why? Simply because I will not give my services for 25s. to 30s. per week.

I had an offer the other day of a splendid (?) berth. Outdoor wiring under bad conditions and in all weather, for 30s. per week. A most encouraging prospect, but I declined the offer.

No doubt there are many others in the same position as myself, and I am afraid there will be, unless something is done to keep the electrician-plumber-boot-black type in his place, and make employers insist on having certificated engineers, and with them good work.

I might in closing mention one instance which came before my notice some 12 months ago. I was at the time foreman in a contractor's firm. A friend of mine, while talking one day about the unemployed, told me a rather pitiful tale of a man who was "a very clever fellow," and in "the electrical line." He had been out of a berth for some time, and was very poor. I said I would see what I could do for him, and I obtained his address and asked him for some particulars of his experience.

He said he had been in the Navy, had got his own tools and would be very pleased to do his best if he could have a start, &c. To cut a long story short, he had been a stoker in the Navy, and his tools consisted of a pocket knife, a new screw-driver (1d. bazaar type), and pair of pliers. When such men as this are about, willing to work for 15s. per week—and many firms would engage them—is it any wonder that we electrical engineers who want to see some return for our expenditure and study are not wanted? Probably some of your correspondents may wonder why I am unemployed when I have held a foreman's berth, so I will explain.

I left the firm after two years' service, simply because I *would not* look after all the outdoor work, do most of the instrument repairs and other indoor work myself, keep an eye on the books, attend to customers (when the principal was away, and he was out nearly every day), keep two apprentices out of mischief, and work from 8 a.m. to 7 p.m., and sometimes 8 p.m., for 30s. per week.

H. L. C.

September 19th, 1908.

Metal Lamps—and Some Tariffs.

Mr. Joseph, in a previous communication, was rather sceptical about the effect of metal filaments on station outputs, but the reports of station engineers to their committees of a notable falling-off in units sold, coupled with a cheerful hope for future improvement, are now being heard of.

Naturally the A.C. men are the worst sufferers, and if Mr. Joseph could only see some of their present load curves compared with previous years, he would not laugh their fears to scorn.

However, we all hope, and most of us believe, that our 1 watt per (Hefner) C.P. is going to do us a lot of good in assisting us to wrest from our friend, the enemy, the illuminating work we stand in need of.

Many consumers on D.C. circuits are reducing their bills considerably, and at the same time getting a better light, which must diminish the number of complaints that are said to be made by consumers regarding the amount of illumination obtained from 60 watts with a carbon lamp.

Most stations are blessed with a few specimens of the consumer who persists in comparing the light given by a fly-blown 8-C.P. to that of a 40-C.P. mantle, but the temporary loan of a high-voltage "Osram" is a strong rebutting argument against the assertion that "your electric light is bad."

Mr. Hoadley's critic is fortunate enough to be undisturbed by metal filaments or the competition of the ceiling-blackening illuminant vended at Dorking by a placid opposition. Having the bulk of the contracting work in the town in his own hands, he is, perhaps, able to adroitly regulate the inroads of tungsten and tantalum on his output, and thus temper the wind to the shorn lamb.

The object in view of most, if not all, lighting stations is to extract the maximum amount possible from the pockets of consumers and give them a good light. Perhaps the perfect tariff, which has yet to be evolved, will do this, but meanwhile we are certainly now able to do the latter.

Messrs. Hoadley and Joseph are now busy digging in the graveyard of old tariff schemes, and the latter gentleman plumps for a flat rate, with a sliding scale, and a two-rate meter, sagely adding that the average man is not going to be bothered with a lot of complications.

The contract demand system, with a Handcock & Dykes limit indicator which need blink but seldom, is a considerable improvement on Mr. Joseph's scheme, and has been instrumental in capturing some very useful long-hour load at the station with which the writer is connected.

H. Leslie Dixon.

Electricity Works, Leatherhead,
September 15th, 1908.

The Merz-Price System of Automatic Protection for High-Tension Circuits.

Reverting to Mr. Statter's letter in your last issue, we would say that we also are manufacturers of time-limit apparatus, and as such we are able to give due appreciation to Mr. Statter's device *in its proper place*, but whilst agreeing that there are many places calling for the application of

time-limit devices, we submit that they are not used to the best advantage for the protection of high-tension transmission systems against faults on mains.

We have, of course, seen the article in your issue of August 28th, referred to by Mr. Statter, but reading it in its entirety, it appears to us to prove the objections to even the best overload inverse time lag relays when applied to the most economical system of mains. To be economical from all points of view including first cost, freedom from shut-downs, and the utilisation of all copper laid in the ground, the system introduces ring mains, inter-connectors, loops, and other various connections enabling every sub-station on the system to be fed directly or through other sub-stations from one or more power stations by at least two different routes.

The article at the same time draws attention to the essence of successful protection which is to cut out any faulty cable without cutting off the supply to any of the sub-stations or consumers. We cannot conceive any adjustment of time limits which would achieve this end on such connections, as shown by figs. 4 and 5 in the article in question, and even were time limits possible, they would be contrary to the demand which calls for the instantaneous isolation of a fault.

We would make it clear that we do not disparage the manufacture of time-limit devices, as the number of cables to be protected on large transmission schemes are small in comparison to the other uses to which time limits can be successfully applied.

A. Reyrolle & Co., Ltd.
H. W. Clothier.

Hebburn-on-Tyne,
September 15*th*, 1908.

Welding v. Bonding.

Our attention has been called to the review of "Electric Traction" by Ernest Wilson and Francis Lydall, which appears in your issue of the 11th inst., page 437.

Your reviewer says, "The authors are wrong in stating that welding is a substitute for bonding, at least the Falk cast-welded and the Thermit welded joints should be bonded."

We beg to point out to you that your reviewer is incorrect in this statement, certainly as regards the "Thermit" joint. Welding by this process has now been carried out in some 50 systems in the United Kingdom, and although in some instances one bond has been used, it is not, in our opinion, at all necessary; nor is it our practice to use bonds unless by special request.

We can give your reviewer the names of a large number of systems where no bond has been used. This, of course, refers to bonds at the joints, and not to cross bonds, which are used in every case.

The conductivity of a "Thermit" welded joint is better than a fish-plated joint with two bonds, and, moreover, the joint possesses the advantage that this conductivity is permanent, whereas that of a bonded joint will fall off after the first year or two.

Thermit, Ltd.,
R. Stutz, *Managing Director.*

London, E.C., *September* 18*th*, 1908.

Competition in Electric Wiring.

With reference to your leaderette in the last issue of the Review, I beg to put forward one reason (which ought to be well known by this time) for the disparity in the tenders for electric light work. This reason is that the specifications generally given out are such only in name, and leave too much to the contractor to settle, to slur over, or to avoid.

In my humble opinion, a specification ought, as far as possible, to specify *everything*. Thus, the position of each lamp, fitting, motor, fan, heater, switch, plug socket, distribution board, main board, &c., should be indicated on a plan of each floor of the building, and on the walls and ceilings of the building itself. Further, the exact make and type or catalogue number of every item should be given; and lastly, the lay-out of the circuits and their gauges should be specified, as well as the system of wiring, the tests demanded, and those general matters which, as a rule, are all that are found in specifications.

If a consulting engineer be employed, it is *his* business, not the contractor's, to go into the above details and to settle them once and for all with the customer; and the latter ought not to have to be worried by the contractor for the settlement of details during the progress of the work.

Such detailed specifications would save the contractor's time and enable him to tender with a clear mind as to what was wanted. The progress of the work also would be immensely facilitated.

W. Perren Maycock.

London, S.E.,
September 21*st*, 1908.

I have read with interest the leading article in your issue of the 18th inst. with reference to the various tenders received for the wiring work at Messrs. Selfridge's premises in Oxford Street.

The explanation does not seem difficult to anybody who has an intimate knowledge of the electrical contracting business and this is best illustrated by a reference to the purchasing price of suits of clothes, watches or even ampere-meters, where the difference in price is not merely 100 per cent., but often 200 and 300 per cent., or more. It is very difficult to determine the difference between a low and a high priced suit of clothes, until they have been worn a considerable period; very often the low priced article looks better, seems to fit better, and as one cannot, without destroying it, look into the inner details and construction, one has to believe it is as well made internally. Those who buy higher priced suits of clothes, however, find that the extra first cost expenditure is thoroughly justified in the result. The clothes wear longer, look well all the time, the materials used, both in sight and out of sight, are of such a nature as to secure satisfaction the whole time one is wearing the article.

The same applies to watches with a considerable difference in price, where the difference between two watches is difficult to specify, or being specified, difficult to see. With electrical measuring instruments the low-priced instrument is quite a different article from the high-priced one, while again it is very difficult to prove that both of them are not equal, certainly when first put to work. Why then does the demand for the high-priced article continue? I venture to say because there are people who know that good quality exists in the high-priced article and that the makers make the goods not for immediate profit alone, but for the purpose of maintaining their reputation.

Anybody wishing to buy an ordinary article of commerce, such as the three articles I have mentioned above, or an electrical installation, and asking a large number of firms to give a price, would find himself in a very much more uncertain position than the unfortunate consulting engineer who had to deal with the tenders made to Messrs. Selfridge. It is perfectly clear that neither Messrs. Rashleigh Phipps and Co. nor Messrs. Drake & Gorham proposed to make a profit which would be equivalent to the difference between their price and the prices submitted by the firm whose offer was accepted. Probably the gross profits of these two firms were less than the estimated gross profit of the firm whose offer has been accepted, so that they were anticipating to get a lower percentage rate of gross profit.

The state of the industry at the present time is not one that would justify any of the firms submitting a price that was out of all reason, and I am thoroughly convinced that, if the higher-priced offers had been accepted, Messrs. Selfridge would have got better value for their money than by accepting, as they did, the lowest tender.

Having had, at different times, to act on behalf of clients who wished to accept the lowest tender from a large range of firms tendering, I am fully aware of the difficulty of ensuring that the purchaser really gets the same installation from the "low-price" tenderer as would be given by the "high-price" one, and have felt it impossible to ensure a different result without in any way failing to look after the client's interests in exact accordance with the terms of a careful, detailed and practical specification.

In the old days I tendered for a large number of installa-

tions without success, due to my prices being higher than those accepted. In many cases I subsequently saw these installations, both when just completed and after they had been in use a number of years, and then realised how it was my price was too high. Although quoting what seemed high prices and receiving a fair number of orders and employing reliable men, I found it an impossibility to put into the installations that class of work and material which I considered was the best, and at the same time to make a sufficient margin of profit to continue in the business.

In conclusion, it seems to me particularly unfortunate that an installation of the kind that Messrs. Selfridge's magnificent building demands should be cut down to an impossibly low price, for surely the cost of the building must be many hundred times greater than either the highest or the lowest offer submitted, and the business will be permanently burdened with that doubtful luxury—a low-priced and therefore anxiety-giving electrical installation.

I do not wish it to be thought that I in any way imply that the accepted contractors will not fulfil their obligations, but I wish to express my sympathy with them, with the purchasers, with the consulting engineer and the electrical industry because another so-called "cheap job" has been undertaken, as I am sure it will be a matter of regret to all four.

Ex-Contractor.

Automatic Lifts.

I note an article written by a correspondent in your issue of September 11th, on automatic lifts, dealing with the inconvenience caused by lazy, careless and selfish people leaving the gate open after using such a lift. May I point out that there are several "self-closing" devices on the market which eliminate the objections raised. An ordinary spring in many cases is all that is required to secure the reclosing of the lift door the moment it is released. My electric automatic locks (see brochure herewith) can be used with such a device, but I have also an apparatus for self-opening and interlocking lift gates as well as a self-closing gear, which does away with the necessity of touching any gate or door.

E. Chaudoir.

London, E.C., *Sept. 16th*, 1908.

With reference to the article on "Automatic Electric Lifts," which appeared in your issue of September 11th, your correspondent mentions, as a last word, that automatic lifts should be fitted with self-closing doors. It is very evident that your correspondent has not seen many of the more modern automatic lifts which have been erected in London, as for at least the last four years we have been fitting automatic closing gates to automatic lifts wherever possible. Of course, there are cases where the customer, for economy's sake or other reasons, omits this item, but we most sincerely agree with your correspondent that automatic gates are extremely desirable, as, without them, one man can throw the whole machine entirely out of use.

R. Waygood & Co., Ltd.
D. W. R. Green, *Director and Secretary.*

London, S.E., *September 17th*, 1908.

I notice in your issue of the 11th inst., under the above heading in your "Notes" column, that a correspondent points out the very serious disadvantage from which these lifts suffer, *i.e.*, that a door may be left open by any careless or selfish passenger who uses the lift. I would point out that my firm have, for a long time, fitted automatic doors to their push-button lifts with very satisfactory results. In fact, no automatic lift, where there is no attendant, ought to be installed unless the doors are made to automatically close, as the chief, or in fact, only advantage of this type of lift is done away with, apart from it being highly dangerous.

I agree with your correspondent that an automatic lift is not suitable to large buildings. I do not even consider them suitable for small office buildings where installed singly, but they are ideal for private houses.

I do not quite agree with your correspondent that a building should be big enough to require the services of, say, four lifts. This surely depends on the requirements of the building, not only in size, but also the amount of use that the lifts may be put to.

Large lifts have the drawback that the first passenger in has to wait for others to get in, as the attendant is generally reluctant to go up with a single passenger. Two push-button lifts will be found far more useful than one large switch-in car.

Certainly the lifts in London are far too slow, but we are a very conservative nation, and we cannot expect the general public to take to a fast express lift running at, say, 400 ft. per minute (such as my firm have installed at Messrs. Gamages), like ducks to a pond.

Of course, during the last few years the tubes have done a great deal towards making lifts more popular, but none of these run at a greater speed than 150 ft. even in the deepest shafts.

Londoners do not appreciate what a fast lift is really like. There would have been a grand opportunity of showing them at the Franco-British Exhibition, where we were to have installed a lift to hold 20 people, and run at 550 ft. per minute in the Imperial Tower. This, of course, fell through owing to the tower not being put up.

Most of our buildings are not tall enough to require a very high speed, as an express lift, to be of any real use, should not stop till, say, the third or fourth floor, leaving the slow or local lift to serve the lower floors, and except for a few isolated cases, we have no buildings over six or seven floors.

Express lifts should always be of the variable speed type, our experience being that six speeds is the most suitable, and then the resistances must be large enough to admit of considerable running on the low speeds without undue heating.

Even with a variable speed controller, we find that a very severe strain is thrown on the gearing, due to the continual starting and stopping, and with a single-speed lift the strain is far worse, and is bound to lead to trouble sooner or later.

In conclusion, I would draw attention to the fact that all push-button controller lifts should be installed so that the doors close automatically, but without undue noise; otherwise this type of lift should not be installed, but the ordinary "switch-in-cage," with attendant.

Chas. Wyatt, A.M.I.E.E.

London, E.C., *September 17th*, 1908.

Meters.

One so seldom sees in technical papers any reference to that important subject, Electricity Meters, that I was glad to read the short article by your contributor "Jacques" upon this matter, although my experience has led me to conclusions quite opposite to those arrived at by him.

As regards errors due to inaccurate calibration, I scarcely think that these cancel out, as the average consumer is quicker at discovering a fast meter than a slow one, and a type of instrument having a wide variation as regards accuracy occasions a greater loss than would accrue from a meter having a less variation, and it is my experience that watt-hour meters are great sinners in this respect.

Why does "Jacques" assume a shunt loss of 5 watts? Ours, of a very well-known type, take 7½ to 8 watts at 230 volts, and most engineers will be envious to hear that his average lighting meter deals with 1,460 units per annum.

I feel sure he makes assumptions far too favourable to the watt-hour meter. By the way, as these instruments are frequently named erroneously, why not call them joule-meters?

Again, I should not expect that the equivalent rise in volts over the whole lighting period would be 2 per cent., except for a very compact system. On the average network this figure would hold good only near feeding points. However, if there is such a rise, what is to prevent his watt-hour meters being calibrated in agreement?

My experience of watt-hour meters of certain electrolytic and mercury-motor types has been that they are distinctly superior to joule meters in all working quantities, and that the shunt losses of the latter are not counterbalanced by an

equivalent gain, except on circuits liable to great voltage fluctuations—for example, on switchboards, and here they should be calibrated in position.

W. G. Powell.

Cork, *September 20th*, 1908.

[Some correspondence has been received too late for publication in this issue.—EDS. E.R.]

CITY AND SOUTH LONDON RAILWAY FIRE.

THE report of Lieut.-Col. H. A. Yorke and Mr. A. P. Trotter to the Board of Trade, on the result of their inquiry into the fire that occurred on July 16th on the City and South London Railway, has now been issued. It states that the portion of the line upon which the fire occurred, viz., the extension of the railway from the Borough to Moorgate Street, is in two "tubes," each having an internal diameter of 11 ft. 6 in., but about 40 yds. south of Moorgate Street Station these two tunnels open into a large tunnel, the internal diameter of which varies from 29 ft. to 25 ft., and in which scissors crossings were laid between the up and down lines, so as to enable trains to arrive at and depart from either platform, Moorgate Street at that time being a terminal station. In November, 1901, the railway was further extended from Moorgate Street to Islington, and one of the crossings forming the "scissors" at Moorgate Street was then removed.

The sleepers in the small tunnels are 7 ft. long, 12 in. wide, and 6 in. deep; they rest for a distance of about 12 in. at each end upon concrete, which is built up from the iron lining of the "tube." The sleepers in the big tunnel are about 22 ft. in length, 12 in. wide, and 9 in. deep, and they extend right across from the up to the down line. They are supported at the ends and at two intermediate places on concrete pillars, built up from the lining of the tunnel. All the sleepers are of pitch pine "burnettised." The depth between the top of the sleepers and the lowest portion of the tunnel is, in the small tunnels, 1 ft. 3 in., and in the large tunnel from 8 to 9 ft. The spaces between the rails at the cross-over road are covered with a similar planking as far as possible.

When Moorgate Street was a terminal station, a signal box, constructed of wood, was erected upon steel girders above the scissors crossing; when, however, the line was extended to Islington, a new signal-box was built at the north end of and between the station platforms, and the old box in the tunnel was put out of use, but was not dismantled.

Under the present regulations of the Board of Trade, issued in 1904, no wooden signal-box or other wooden structure is permitted to be erected underground on any "tube" railway, and the pathway between the rails is required to be formed of granolithic slabs or of similar material.

The officials at Moorgate Street observed the fire at about 5.40 p.m., and endeavoured to extinguish it with sand. They subdued it sufficiently to allow trains to pass at 5.42 and 5.43, but after the departure of the latter, the fire broke out again, and the current was switched off the section. The draught created by the trains probably fanned the flames, and the station-master, seeing that the fire could not be extinguished with the appliances available, called upon the passengers in the next train, who numbered about 120, to ascend to the surface. This was done without trouble or excitement, after which the station staff ascended, and a telephone message was sent to the power house to cut off the current from the whole line. Before this was done, one of the cables "blew out." The alarm was given to the Fire Brigade at 6.6 p.m., and the fire engines arrived at Moorgate Street three minutes later. The smoke was then very dense, and the firemen were unable to penetrate into the tunnel—either there, or at Old Street at 6.55 p.m. However, they had no difficulty in descending at the Bank Station, and reached the seat of the fire at about 8.30 p.m., after which the fire was extinguished with water without difficulty.

It is not possible to say with certainty what was the actual origin of the fire. From the evidence given at the inquiry by Mr. McMahon, the electrical engineer of the company, it would appear that leakage of electric current has been known to occur between the power rail and the running rails, due to an accumulation of iron dust and carbon dust on the sleepers and insulators, the leakage being sufficient to set this dust and the upper surface of the sleepers on fire. It is possible that the present fire was caused in some such manner, or it might have happened that this dust was ignited by sparks from the shoes of a locomotive.

Having regard to the considerable time which elapsed between the discovery of the fire and any signs of electric arc on the spot, or opening of circuit-breakers at the works, it seems probable that the fire did not originate from any defect in the insulation or in the continuity of the electrical cables, but began with a smouldering which may have developed into flames by the draught of passing trains.

Although permanent way men walk through the tunnels every night, clearing away rubbish, the tunnels are extremely dirty, and some of the dirt is of a dangerous character, namely, that which consists of iron dust and carbon dust, the former from the brake shoes, wheels and rails, the latter from the carbon brushes of the motors. In addition to this, there is in some places a good deal of oil drippings. The insulators are said to be cleaned once in three or four months.

This dust is inflammable. The coating of dust on a wire will burn with a smouldering glow, if ignited, and will, if fanned, say by the draught of a passing train, burst into flames. The sides of the tunnels and the wires carried along them are covered with it. When dust accumulates on an insulator it sometimes forms a path for an electric leak, which ignites it, and this may set fire to a sleeper. Such small fires have been experienced. When a driver sees one, he informs the station-master of the next station, who telephones back, and the driver of another train, being warned, stops and extinguishes it with a brush. Pieces of waste have also been found on fire. Each locomotive carries a bucket of sand and a 10-gallon tank of water, which is connected with the compressed air tank, enabling a jet to be thrown.

Had the large space in the invert below the cross-over, some 20 ft. wide by 64 ft. long and 8 ft. deep at the middle, been filled in and flush with the sleepers, it seems likely that the fire, confined to the surface, could have been extinguished by sand.

The fire spread laterally in both directions, but lengthwise only for a few feet. As the flames and heat increased, the disused signal cabin above the cross-over road took fire, and was completely burned out.

The original accounts of the event were much exaggerated; at no time were any passengers in danger. It appears that according to the ordinary course, if there is any unusual delay, the signalmen, without waiting for orders, would switch the lights on in the tunnel, and the driver would put his telephone on to the wires and communicate with the signalman, and ask for instructions. The passengers, if necessary, could leave the train at either end, and would walk out along a lighted tunnel.

"With a view to reducing the risk of fire, or, what is worse than fire, of smoke, we make the following recommendations, namely:—

"1. Considerably greater attention should be given to cleanliness; dust should be more carefully removed.

"2. A liberal use of whitewash would enable any accumulation of dust to be detected.

"3. The filling up of the inverts, particularly of the large tunnels, should be carried out.

"4. No electric wires or cables should be carried below or between the sleepers, but should be neatly arranged along the sides of the tunnels, and all crossing of cables should be overhead.

"5. The use of wood should be eliminated as far as possible; the planking and the wooden platforms should be replaced by slate or granolithic slabs.

"6. On discovery of a fire, all traffic should be stopped in that section until the fire is completely extinguished.

"7. Prompt notice should be given to the Fire Brigade."

BOURNEMOUTH CORPORATION TRAMWAY ACCIDENT.

THE report to the Board of Trade, drawn up by Major J. W. Pringle, who conducted the inquiry, as to the cause of the accident which occurred on the Bournemouth Corporation Tramways about 6.50 p.m. on May 1st, has just been published.

In this case, car No. 72 was descending the incline from St. Michael's Church, Poole Road, into Bournemouth Square, *viâ* Poole Hill, the Triangle, and Avenue Road, when the driver lost control. The car attained a dangerously high speed, and eventually left the rails at the right-hand curve in Avenue Road, near the School of Cookery. It then crossed the left-hand footpath and plunged down a bank into the private garden of Fairlight Glen House, where it came to rest on the steep wooded slope, lying on its right side.

There were at the time from 35 to 40 passengers on the car—10 inside and the remainder on the upper deck. Of these, seven were killed, or died very shortly afterwards, and 26 were injured, some of them very seriously. The driver, who remained at his post, sustained a fractured rib and other injuries.

Car No. 72 was a double-deck (without top cover) bogie car, with eight wheels and maximum traction trucks (large wheels leading). It weighed about 12 tons unloaded and had seating accommodation for 30 inside and 34 outside passengers. The braking equipment included—

1. Hand wheel brake on all eight wheels.

2. Electromagnetic track brake, with four shoes, two on each rail.

3. In addition, there was available the braking effect obtained by reversing the motors and using power either in series or on the highest (parallel) notch.

The car was fitted with four sand boxes, one at each corner, of the non-automatic type.

The average gradient on the incline is about 1 in 18. The route, as a whole, is not one which, from the point of view of either curvature or gradient, can be described as exceptional for tramway working.

The Board of Trade Regulations governing the traffic on the downhill route are as follows:—

1. Speed limited to six miles an hour in Poole Hill, the Triangle, and Avenue Road as far as Fairlight Glen House, just above which the derailment took place.

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2. All cars have to be brought to a standstill at the top of Poole Hill.

3. The track brake must be applied on all falling gradients of 1 in 15 or steeper.

In addition to the above, the Corporation had imposed compulsory stops on Poole Hill at Par's Corner, and in Avenue Road at Robson's Corner.

Judged by the number of fatalities, this accident is the most serious which has occurred on tramways in the United Kingdom. The general circumstances, however, are not peculiar. The deplorably long list of killed and injured in this case was due to the large number of passengers who happened to be travelling on the upper deck of the car, and to the unfortunate contingency that, just at the point of derailment, there was nothing substantial enough to prevent the car from plunging down the embankment and overturning.

On the day of the accident (May 1st) No. 72 car was driven by six different men, and travelled 99·4 miles. At 3 p.m. No. 1 controller was reported out of gear. Inspector Rushton readjusted the barrel, tested the controller, and found it worked properly. At 5.20 p.m. driver Wilton took charge of the car at Lansdown, and drove it from No. 1 end westward to the terminus at Poole, where he arrived about 6.8 p.m. He used the magnetic brake on this journey in descending Constitution Hill, and found it worked perfectly. Wilton left the terminus at Poole on his eastward journey to Bournemouth about 6.10 p.m., driving from No. 2 end. As far as the conduit pit in Poole Road, about 4½ miles from the terminus, the journey was uneventful. The car was brought to rest at the conduit pit, and the plough attached to the underground conductor. Wilton restarted the car, by using one or two notches of power, until a speed of 3 or 4 miles an hour was attained. Power was then shut off, and the car allowed to run a little distance without power. He applied three notches of magnetic brake about 65 yards from the conduit pit. There was no effect, and Wilton's first impression was that he had missed making contact on the notches. He worked further notches on the brake side and used sand, but there was still no effect. By this time the car was close to the usual stopping place at Par's Corner, and had attained a speed of 10 or 12 miles an hour. He realised that the brake had failed; but was so confident that it was only a temporary failure, that he brought his controller handle from the brake into the "off" position, and allowed the car to run freely round Par's Corner. He then reapplied the magnetic brake in the same manner notch by notch, but again without effect. A little more than half way between Par's and Robson's Corners—*i.e.*, about 280 yards from the top of the hill—Wilton applied his reversing power, by bringing his controller handle into the "off" position, moving the reversing key into the backward position, and then using power, notch by notch, as far as the fifth. This had no retarding effect, although the automatic canopy switch was blown, and the car had attained a speed of 20 to 25 miles an hour at Robson's Corner. Wilton then used his hand brake, which he had held in position ready to apply it all down the hill, but the speed was so great that there was little or no retardation, and the car left the rails on the curve above Fairlight Glen House, as has been described, about 460 yards from the starting point at the top of the hill. Wilton's explanation for relying so long upon his magnetic brake was that on another occasion, about a year previous, the magnetic brake failed the first time he tried it, but worked beautifully on the second attempt. If he had known that the magnetic brake was not to be relied on, he could have taken the car down the hill in safety with the hand brake only. Wilton was absolutely sober on May 1st; and he bears an excellent character for general sobriety and carefulness.

On the curve where derailment took place, the original rails were taken up and relaid two or three years ago after the derailment of another car at the same place. The outer rail was then raised so as to provide some superelevation, and a check rail was fitted to the inner rail.

On May 14th certain trials were made on this particular curve, and speeds up to 12 to 13 miles an hour attained by different cars without derailment. These trials prove at all events that, notwithstanding the large amount of wear on the rails in proximity to the site of the accident, as regards speed there was a considerable margin of safety beyond the authorised limit of six miles an hour, provided the wheel flanges were in fair condition. But the worn condition of the rails at the point of derailment and of the flanges was to some extent a contributory factor in the case.

The Inspector examined car 72 before it had been moved from the position it occupied after the accident. The hand brake was applied, and the blocks were bearing on all wheels. At No. 2 (leading) end both handles were in position on the controller, the reversing key being in the "backward" position, and the large handle at the last (seventh) brake notch. The automatic canopy switch was "out." No. 2 controller was in good condition. One of the leads attached to the coil of the off rear magnetic brake shoe was broken, the break being of old standing; the insulation of the other lead to the same coil was damaged. Inside the car the leads to this shoe were disconnected. Only three out of the four magnetic shoes were therefore available for use.

There were some indications of "flats" on the treads of some of the wheels, but the marks were all so slight that it was evident that the wheels could not have skidded for any appreciable distance on the journey down the hill. The tires of the driving wheels showed signs of much wear.

The cover of No. 1 controller was removed by Mr. Lait, depôt superintendent, and foreman Robinson, on the evening of May 2nd. They found the reversing or motor barrel of this controller was not in its proper "off" position, but midway between "off" and "reverse," and that there was contact made with several of the reversing fingers. It was not realised at the time what effect this position of the reversing barrel in No. 1 controller would have when the magnetic brake was applied from No. 2 controller. Nothing was therefore said at the time by these witnesses to anyone else regarding the wrong position of the barrel. They easily turned or jarred the barrel back into its proper "off" position.

But the fact, which the evidence establishes, that, when Wilton lost control of the car, the reversing barrel at No. 1 end was making contact with the reversing fingers explains the failure of both the magnetic brake and the reversing power. The effect of this contact (with this type of controller), whilst the car was being driven from No. 2 end, would be to short-circuit the armatures of the motors, and prevent the generation of current by the motors. Consequently there would be no magnetisation of the steel blocks forming the shoes, and no attraction would be set up between the shoes and the rails. Similarly there would be no retardation when the reversing key was placed in the backward position, and the controller handle used in the highest power notches.

At the time No. 72 car got out of control, it did not therefore matter whether there were three or four magnetic shoes available, for all would have been rendered useless by the position of the reversing barrel at No. 1 end.

There was so much slack play in the reversing barrel of No. 1 controller, that it was possible to move it by hand from the "off" into the midway position described, without using the handles. It was also possible to effect the same result by manipulating the large handle sharply. The effect in both cases could be obtained without causing the teeth to override.

The looseness in the working of No. 1 controller noticed by several of the witnesses may be accounted for by the fact that the original reversing barrel, supplied with the controller in 1906, had been replaced by another and older barrel, which had seen previous service. This barrel, besides having been subject to more wear and tear, may possibly have fitted the new controller with less accuracy.

Major Pringle's general conclusions on the whole case are as follows:—

1. The initial cause of the car getting out of control on this occasion was the incorrect position of the reversing barrel of No. 1 controller at the rear end, which rendered useless all the electrical braking equipment whilst the car was being driven from No. 2 controller.

2. Consequently the only available means of checking the speed of the car down the hill was the hand brake with its wheel blocks. These were in good order, and if Wilton had recognised at an earlier moment—say, when he was rounding Par's Corner—that the magnetic brake and reversing power were useless, he could, by careful management of the hand brake, and the use of sand, have negotiated the remainder of the decline in safety.

3. The incorrect position of the reversing barrel was not, in my opinion, due to mismanagement of the handles by the driver, but to looseness in the mechanism of the controller, due to wear and tear and want of proper maintenance.

Wilton's failure to recognise more quickly that his electric brakes were useless does not, in my opinion, amount to more than an error of judgment; and he deserves credit for remaining at his post till the last moment.

No cars should be permitted to be on service without their full brake equipment.

The position of the sand pipes in the large cars can be improved. On No. 72 they were placed 24 in. from the wheel contact. Dry sand delivered at such a distance will of necessity fall clear of the rails on a curve, and even on a straight road be more liable to be blown away from the desired spot by any current of air. The distance should be reduced by one-half at least.

The rails on the curve where derailment took place require to be renewed, preferably with a wider groove than that originally used.

As regards the magnetic brake, it is now generally recognised that it should not be reserved only for emergency purposes, and for descending steep gradients, but should be in common use.

The training of drivers is not given the attention it deserves.

The organisation of the tramway department is open to criticism. So far there has been no regular manager at Bournmouth. The control seems to have been divided between the borough engineer, the traffic manager, and others. No one officer is responsible to the Corporation for the administration of the whole undertaking. This cannot be a satisfactory arrangement. I strongly advise the Corporation to make a change in the organisation, by selecting in open competition a properly qualified general manager, and giving him control over the whole department. The critical period for tramways is not during the first three or four years, when equipments, &c., are comparatively new. It is later on, when mechanism begins to wear out and renewals have to be made. Previous experience of some length is then of first importancee.

Lancashire Depression and the Electrical Industry.

—A correspondent learns from representatives of several leading cotton spinning and manufacturing firms, as well as colliery proprietors in South-East Lancashire, that the wave of depression and uncertainty now being experienced in Lancashire is keeping back various developments, including the substitution of electrical for steam driving, which they have had under consideration for some time past. They assure the writer, however, that the schemes will be put into operation as soon as practicable.

ELECTRIC COOKING APPARATUS.

We are pleased to observe—on the strength of three demonstrations of electric cooking, which have come to our knowledge within four days—that the manufacturers of apparatus and suppliers of electricity for this purpose are bestirring themselves in good earnest. We have on previous occasions insisted on the importance of the applications of electricity to cooking and heating; continued improvements in the apparatus and utensils employed will do much to hasten the popular realisation of the advantages of electricity, with corresponding benefit to the supply engineer's much-petted load-factor, and one of the most important directions in which improvement can take place is in that of cheapness.

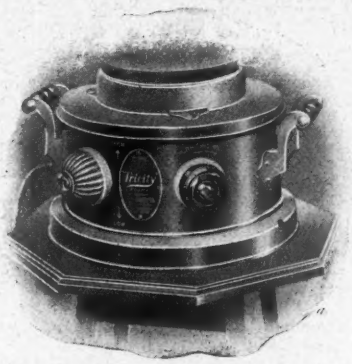


Fig. 1.—The "Tricity" Cooker.

This must not, however, be obtained at the cost of durability, and nothing can have a more deterrent effect upon actual or would-be users than repeated breakdowns. In this respect the "Tricity" cooker, which is being introduced by the Berry Construction Co., Ltd., Charing Cross House, London, W.C., possesses the great advantage that it can be left in at full power all day without suffering the slightest injury; it may, in fact, be used as an efficient radiator for heating a room, as it can easily be carried about, and can be connected with a wall-plug. The "Tricity" cooker differs entirely from any other electric cooker with which we are acquainted; it consists essentially of a transformer, the secondary of which energises a copper heating coil situated close to the lower side of a cast-iron disk, which forms the top of the cooker—the business end of it. The disk is heated partly by conduction from the coil and partly by induced eddy currents; as there is a fairly strong magnetic field above the dish, any metallic object, such as a flatiron, placed on the dish is also heated by eddy currents, which hasten the rate of heating. The iron disk is insulated thermally and electrically by a substantial block of marble. The right-hand switch seen on the front of the cooker gives three degrees of heating, and an "off" position, while the left-hand switch, connecting

Fig. 2.—Cooker with Grill in Position.

the primary windings in series or parallel, doubles the number; the six steps thus obtained range from 150 to 900 watts. The power factor of the cooker (which, it will be observed, can be used only on A.C. circuits) is very high, reaching 96 or 97 per cent. at full load, and not falling below 85 per cent. at light load.

It might be thought that this simple cooker would have a limited range of utility; it can, however, be used for a great variety of cooking operations—boiling, stewing, frying, grilling, toasting, heating irons, &c. The arrangement for grilling is shown in fig. 2; a nickel-plated griller fits closely on the cooking plate, while an annular tin trough surrounding the top of the cooker catches all dripping, &c. At maximum load the cooking plate attains to a dull red heat, visible only in the dark, but hot enough for toasting. The kettles, saucepans, &c., used with this cooker are the ordinary inexpensive patterns, the only modification being the insertion of a flat dished copper bottom, which fits neatly over the plate, and is in close contact with it. As the cooker is neither heavy nor hot, it can stand conveniently on a small table in any room. Chinaware stewpots with flat bottoms, ground to fit the plate, can be used both for cooking and for serving up at table. On placing a wire guard over the cooker, it can be used for airing clothes with perfect safety. With electricity at 1d. per unit, 18 pints of water can be boiled for 1d.; 48 chops can be grilled, or 24 rounds of bread toasted, for the same outlay, and at the lowest heat, 1d. will run the cooker for seven hours. It will be seen that the "Tricity" cooker offers many attractions to the householder, and should prove a valuable aid to the central station engineer, who is desirous of letting out cookers on hire.

We turn now to an account of an electric cooking exhibit at Messrs. James Fleming's Restaurants, Ltd., 68, Oxford Street, W. The cooking apparatus, which was manufactured by the Phœnix Electric Heating Co., Ltd., has been lent for the purpose by the St. Marylebone Borough Council Electricity Department, and the test is being carried out with a view to determining the practical value, both as regards cost and results, of electric cooking. The apparatus

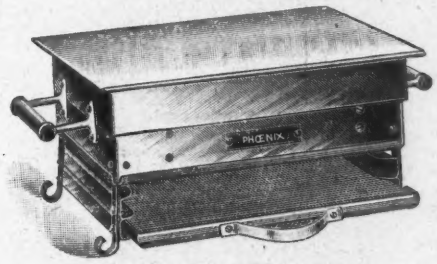


Fig. 3.—The "Phœnix" Griller.

in use comprises one four-heat oven, one 15 in. × 10 in. grill consuming 1,800 watts, one toaster of very similar construction to the grill, one egg poacher consuming 600 watts, and one hot plate. The apparatus is metered separately, and consequently it is possible to arrive at the exact cost of working under practical conditions.

All the chops, steaks and poached eggs supplied by the restaurant are now cooked electrically, and the results have proved most satisfactory. Mr. Fleming, the managing director of the company, has kept the records personally, and as his experience of eight days' working gives the following figures:—

The average daily consumption was 39½ units, the cost of which is approximately 3s. 8d., it being calculated that the price on the maximum demand system will work out at about 1¼d. per unit.

The large grill will cook 12 chops at one time, and the cost in this case is slightly over 1¼d. per hour. In eight days 678 chops and steaks were cooked to this grill, and the cost per chop or steak worked out at three-sixteenths of a penny.

The egg poacher consumes on the average 5½ units per day, and the hotplate and small toasting grill, which are both connected to the same meter, consume 11¾ units; the oven, which is used for heating plates, consumes 8¾ units.

The griller and toaster, which constitute quite a new departure, are very interesting. The griller, which is illustrated in fig. 3, is of new design; it consists of a frame standing on four legs, and carrying beneath the cover an array of spiral "Phœnix" wires supported on insulators. Above the wires there is a thick layer of thermal insulation, surmounted by a polished hot plate, which can be used for keeping dishes warm. Below the wires is the grill, which slides into either of two shelves, so that the grill can be put close to the heaters or further away, according to the requirements of the cooking operation in progress. The wires run at red heat, and are proportioned to suit any voltage up to 250 volts. If desired, a heater can be added under the hot-plate, enabling the latter to be used for boiling.

The griller is made in three standard sizes; that in use at Messrs. Fleming's is the largest, having two divisions each taking about 5 amperes at 200 volts, and can grill chops in 8 to 10 minutes. These grillers, being of the pure resistance type, can be used on either A.C. or D.C. circuits.

From the point of view of the cook, the results have been extremely satisfactory; the electrically-grilled chop or steak is, in Mr. Fleming's opinion, a considerable improvement on those cooked on a gas grill, and, owing greatly to the entire absence of burning, the results are also considered superior to those obtained with a coke or coal fire.

We may add that the St. Marylebone Electricity department also has a large demonstration grill in use at Messrs. Slaters, Oxford Street, and the Green Man public house, Euston Road. Another is being supplied to the Earl Russell, Mortimer Street, and the department is arranging to lend out apparatus in this manner to several other restaurants, dining rooms and flats in the borough. With a view to testing the matter still further, it is also supplying a large oven to Messrs. D. and H. Evans, of Oxford Street, which will be used side by side with several gas ovens.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

The "H. O. F." Ironclad Switch.

Messrs. H. O. Farrell & Co., of Moss Side, Manchester, have sent us particulars of their new "H. O. F." ironclad type knife switch, which we illustrate in fig. 1.

The switch is suitable for any pressure up to 500 volts. It is fitted with double blades, so designed that in closing the switch the ends of the blade entering the top contact are forced together, and the

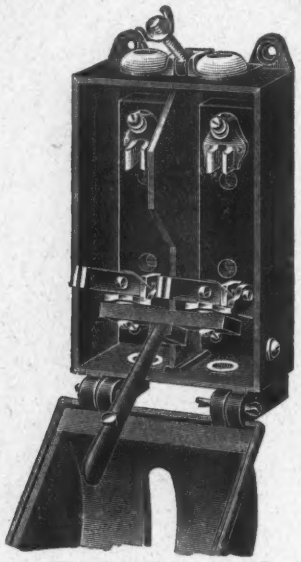


Fig. 1.—The H. O. F. Ironclad Switch.

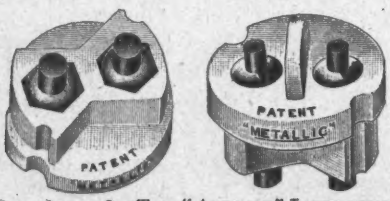
other ends, in the pivot contact block, are correspondingly forced apart, thus giving good contact pressure at both ends of the blade. In opening the switch, the release of the blades from the top contacts immediately relieves the pressure at the pivot and leaves the blades free to open rapidly. The switch cannot remain in an intermediate position, and the arrangement provides for taking up the wear automatically.

The switch cases are asbestos-lined, and the cable holes are bushed.

New Patent Lampholder, and Conduit Clip.

Few electrical appliances have called forth greater ingenuity or resulted in a greater number of patents than the incandescent lampholder. We have never, however, seen a more ingenious device than that which has just been brought out by the Metallic Seamless Tube Co., Ltd., Wiggin Street, Birmingham, and is illustrated herewith.

The essential novelty in the construction of this holder is the provision for wiring. Perhaps the most objectionable detail in the ordinary holder is the screw terminal attachment. The confined space, and the high voltages to be dealt with, render it a difficult matter to devise a really satisfactory attachment, though some remarkably clever methods have been introduced. In the early days, when little, if any, care was taken to provide against the accidental contact of loose strands of flexible wire with the metallic shell of the holder, innumerable short-circuits took place, and we have no doubt that human lives have been lost through



Figs. 2 and 3.—The "Automat" Lampholder.

contact with live holders. The ideal would be a terminal continuous and concentric with the lamp lead, with no screw attachment, yet so powerful a grip that the lead could not be pulled out; the metal parts to be surrounded by porcelain, and the danger of loose strands to be entirely obviated. We are bold enough to assert that the holder before us conforms closely to this ideal in every respect.

The operation of wiring is simplicity itself: push the copper wire into the terminal, then pull it, and the operation is completed. The wire itself will give way rather than slip; we have proved this by trials with flexible and solid wires. The contact is electrically excellent. There is nothing tricky about the device; any fool can use it, and can hardly make any mistake, though the ability of fools to find ways of making mistakes is truly marvellous. The parts are enclosed in porcelain except at the end, and the ends of the leads are entirely enclosed within the terminals.

The lampholder is shown in the accompanying figures 2 and 3. The terminal consists of a brass cylinder enclosing the usual plunger and spring for the lamp contact, and a second plunger which receives the wire; the whole is held together by a tubular nut screwing on to the cylinder aforesaid. It will be noted that only

Fig. 4.—Conduit Supported by New Pattern Clips.

one spring is used. The second plunger is drilled to receive the wire (which cannot, however, pass completely through it), and possesses a conical enlargement at the middle, with three apertures in which are housed tiny brass balls. The interior of the brass nut is also slightly tapered. It will be seen that when a wire is pushed into the terminal it will pass between the balls; on pulling the wire, the spring will push out the plunger, wedging the balls between the wire and the conical seat, and the harder the wire is pulled the more tightly it is gripped. The electrical contact is direct from the wire through the balls to the nut. A more simple or effective device could hardly be imagined, and we congratulate the inventor upon this admirable product of his ingenuity.

The Metallic Seamless Tube Co. are also introducing a new pattern clip for conduit work (registered design No. 529,053), which is intended for fixing conduit runs on uneven walls or in damp situations. Fig. 4 shows a section of tube supported by two of these clips.

BUSINESS NOTES.

The Rubber Exhibition.—The International Rubber and Allied Trades Exhibition at Olympia, which opened on the 14th inst., and will close to-morrow, is the first of its kind, though a non-international Rubber Exhibition, the parent of the present one, was held in Ceylon in 1906, Sir Henry Blake being president of both. While the exhibits in general appeal rather to the numerous persons connected with the rubber and allied trades than to the general public, there is much to interest the layman in the Exhibition, and it is surprising to find how largely we are dependent upon rubber for the innumerable conveniences and comforts of modern civilisation.

We hardly need say that the cultivation, collection and manufacture of rubber are exhaustively exemplified in the Exhibition, which has been supported by numerous Governments, colonial and foreign; Ceylon, the nursery of the cultivated rubber tree, is especially prominent, her plantations now occupying 180,000 acres, and in a few years' time the output of rubber from this colony will probably be very large and valuable. The Straits Settlements and Malay States, into which Para rubber was introduced from Ceylon, have also a good exhibit, while the Dutch Colonies, Brazil (the chief source of native rubber), Mexico, and the West Indies, also show important exhibits.

Turning to the private exhibitors, we note that the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., of Silvertown, show a great variety of rubber goods, including, of course, many applications of pure and vulcanised rubber and ebonite to electrical purposes, with which our readers are already familiar. Pliers with ebonite-covered handles, beautifully finished; ebonite-covered bolts for switchboard panels, &c.; ebonite parts for telephone instruments and apparatus, and vulcanised fibre, were amongst the items that we noticed at their stand. Cycle and motor tires, golf balls, &c., are not without interest to many electrical men, to say nothing of insulated cables. The principal feature of the stand is the new mosaic india-rubber tiling which the company have just introduced, and which being silent, clean, durable and ornamental, forms an ideal flooring material. Messrs. Bergtheil & Young showed the "Bandy" electric punkahs, and the Société Industrielle des Téléphones exhibited a variety of electric lighting and telephone apparatus.

Dynamometers and other instruments for testing rubber were shown by Messrs. A. D. Cillard Fils, Paris, and Mr. Louis Schopper, Leipsig. Other exhibits of interest to electrical engineers consisted of machines for manufacturing rubber, driven by electric motors; such machines were shown by Messrs. David Bridge & Co., Castleton; Messrs. Francis Shaw & Co., Bradford, Manchester; Messrs. Robt. Warner & Co., Ltd., Walton-on-the-Naze; and Messrs. Werner, Pfleiderer & Perkins, Ltd., Peterborough. Messrs. E. R. & F. Turner, Ltd., Ipswich, showed their chilled steel rolls, and Messrs. Tangyes, Ltd., a number of gas, oil and steam engines. We propose to refer again to some of the exhibits in a future issue.

Book Notices.—*Who's Who in Mining and Metallurgy*, 1908. Founded by George Safford. London: The *Mining Journal*.—This is a new work, and from a perusal of the information appearing in the first issue, we should say that it will be of value to those having to do with the mining and metallurgical industries. Biographical notices appear of mining engineers and metallurgists in this and some other countries, and the rest of the book is occupied with particulars of the various institutes and societies at home and abroad to which such men belong. The price (15s.) may seem high for a book of less than 200 pages, but it is well bound and its gilt lettering and edging give it a good appearance.

"Calcul Electrique et Mécanique des Distributions d'Energie." Lecture by J. H. Jacobsen. Paris: From the author, 23, Rue Bandin. Price 2 fr. 25 c.

"Transactions of the North-East Coast Institute of Engineers and Shipbuilders." September. Vol. XXIV, Part 8. London and Newcastle: A. Reid & Co. 1908.

"Tin-Plate Working." By R. H. Clarke. London: Technical Publishing Co., Ltd. 1908. Price 1s. 6d. net.

"Modern Power Gas Producer Practice and Applications." By H. Allen. London: Technical Publishing Co., Ltd. 1908. Price 6s. net.

Deed of Assignment.—F. A. Fraser and F. O. Mills (Electrical Engineering and Maintenance Co., 49, Lime Street, London, E.C., electrical fittings factors and contractors).—A meeting of creditors was held at the offices of the British Traders' Protection Association, Balfour House, E.C., on 18th inst., Mr. R. Betteley (of the General Electric Co., Ltd., who are the largest trade creditors), presiding. A statement of affairs was submitted, showing assets £1,033, and liabilities £2,291, showing a deficiency of £1,258. A resolution was passed agreeing that the business be carried on by a trustee under a deed of assignment of the whole of the debtors' estate, with power to employ the debtors at £3 per week each, and that the debtors have their discharge when 10s. in the £ has been paid to the trade creditors and all costs and expenses. Mr. G. E. Corfield was appointed trustee, with Messrs. Betteley, J. W. Rook (Sloan Electrical Co., Ltd.) and Mr. E. H. Hawkins as a committee of inspection; the costs of suing creditors to be paid in full. The above arrangements were agreed to subject to the cash creditors postponing their claims until the 10s. in the £ be paid.

A Mexican Contract.—A telegram from Mexico of the date of September 14th, announces that the Siemens-Schuckert Works Co. has obtained, through its branch in that city, the order for the machinery and installation of the hydro-electric works on the Lake of Chapala, near Guadalajara. It is estimated that the total expenditure on the works will amount to £750,000.

Franco-British Exhibition. — Messrs. Alfred Herbert, Ltd., of Coventry, have been awarded the Grand Prix for their exhibit of labour-saving machine tools at the above Exhibition.

Trade Announcements.—The Accessories Manufacturing Co., Ltd., announce that Mr. Arthur A. White, for many years with Messrs. Hale Bros., and latterly with Messrs. Baxter and Caunter, will, from September 26th, be representing them.

The Preston Electric Co., Ltd., have removed their offices to more central and convenient premises at No. 24, Warwick Chambers, Corporation Street, Birmingham (telephone number, 6,052 Central).

Messrs. Duck & Wood, manufacturing electrical engineers, ignition specialists and contractors, are now installed in their new premises, 47, London Road, Croydon, and they invite firms to forward lists.

The Electrical Apparatus Co., Ltd., have now removed their offices to their Battersea Works (Milford Works, Queen's Road, Battersea), where all letters should be addressed.

Auction Sales.—On October 7th, Messrs. Wheatley Kirk, Price & Co. will offer for sale by auction, certain colliery plant, including electric power plant, consequent upon the dismantling of the Blenkinsopp and Gapshields Collieries, Greenhead, near Haltwhistle, Northumberland. On September 30th Mr. Frank G. Bowen will sell by auction at Camden Town, a quantity of surplus electrical, motor, and general engineering plant and stock. Particulars will be found among our advertisements to-day.

Messrs. E. Rushton, Son & Kenyon are to offer the works, plant and stock of W. T. Garnett's Cable Co., Bradford, for sale by auction on October 8th. Particulars appear in an advertisement to-day.

Dissolutions and Liquidations.—The Cycloidal Engine Co., Ltd.—A meeting is to be held at 87-89, Aldgate, E.C., on October 19th, to hear an account of the winding-up from the liquidator, Mr. C. S. Drummond.

The firm of Fyfe, Wilson & Co., electrical engineers, &c., of 74, York Street, Glasgow, of which Mr. A. M. Fyfe and Mr. W. R. Wilson were sole partners, has been dissolved by the retirement of Mr. Wilson. Mr. Fyfe will continue to carry on the business under the old style, and will attend to debts.

The Electrical Instrument Manufacturers, Ltd., Freesywater, Waltham Cross.—First meetings of creditors and contributories are to be held at 14, Bedford Row, London, W.C., on October 2nd.

Fires and their Causes.—The Pearson Fire Alarm, Ltd., Redcross Street, E.C., inform us that, writing from Messrs. Jolly & Sons, Ltd., Milsom Street, Bath, on August 24th last, Mr. J. D. Allen, a director, said:—"Yesterday we had a further proof of the value of your alarm. An electric wire fused and set on fire the gas supply. Within a few minutes the Bath Fire Brigade responded to the call set up by the alarm." The Pearson Co. were the pioneers of fire alarm protection in this country, and are now protecting upwards of £19,000,000 worth of property. The majority of their subscribers use electricity for lighting and power purposes, but out of the 54 fires that have been notified by their alarm, the above is the first instance of one having been caused by electricity. This speaks well for the safety of buildings generally where electricity is used.

Catalogues and Lists.—The General Electric Co., Ltd., 71, Queen Victoria Street, London, E.C.—New pocket size booklet (No. L, 1,258) of 48 pages, in which are given illustrations, brief particulars and prices of the firm's leading lines in electric bells, pushes, indicators, batteries, cells, wires, and cables, of which prices have been reduced; also leaflet S, 1,268, showing, and giving prices of, Osram lamps of 200, 300 and 400 c.p., and illustrating two other new types of these lamps (a 25-volt, 10 and 16-c.p., and a 25-volt, 10, 16 and 25-c.p. Osram, round bulb).

The I.T.E. Electric Co. (1907), Ltd., 72, Finsbury Pavement, E.C.—Leaflet relating to, and giving prices of, the "Shawmut" extended terminal lug type enclosed fuses.

Messrs. Siemens Bros. Dynamo Works, Ltd., York Mansion, Westminster.—Meter pamphlet (40 pp.) containing illustrated particulars, with explanatory diagrams of connections of their ampere-hour and watt-hour meters, and instructions for their use. Also new price sheet, giving particulars of the "Solar" fittings for Tantalum sun and spherical carbon-filament lamps; pendant, corona, and festoon methods of using these fittings are shown.

Leeds Electric Co., Ltd., Park Cross Street, Leeds.—Advance leaflet describing their Goliath and porpoise wire, telephone and bell wires, which it is claimed will not perish or crack with age, and will resist damp and other installation troubles. The inner covering of the wire is of "Resistite." The wire is packed in patent "Autocoil" cases, rendering wiring from any number of colours at one time an easy matter. Porpoise wire is not quite so thickly insulated as Goliath wire.

Endolithic Manufacturing Co., Ltd., 61½, Fore Street, London, E.C.—List with specimen prints of their labels in ivory, metal, &c., for affixing to electrical and other manufactures.

Union Electric Co., Ltd., Park Street, Southwark, S.E.—List No. 1,404, dealing with their hoisting gear, counter-balance weights and accessories for arc lamps; also No. 1,405, relating to their guide attachments and cradles for arc lamps.

The London Electric Firm, George Street, Croydon.—32-page catalogue (No. 113), which contains photographic views of a number of buildings, thoroughfares and other places where the firm's patent positive action weight-relieving contact devices, or their self-sustaining winches, are installed.

Messrs. Drake & Gorham, Ltd., 66, Victoria Street, S.W.—New catalogue, consisting of a number of illustrated lists dealing with a variety of their electrical supplies and manufactures, including tantalum lamps, with many fittings and accessories for same; Osram lamps, with instructions as to their use, and with particulars of fittings, auto-transformers, balancers, &c.; switchboards, switchgear and accessories relating thereto; Watkin switches, two-part china insulators, &c.

The Electric Control, Ltd., Reid Street, Bridgeton, Glasgow.—Advance proof of 20-page pamphlet, wherein they describe their "Empire" electric control apparatus. Automatic starters for D.C. and A.C. are particularised, with wiring diagram, dimensional figures and prices, as are also starters for single-phase motors, auxiliary devices for Empire starters, A.C. solenoid switches, remote-control switches, and remote-control lighting panels.

Messrs. Simplex Conduits, Ltd., Birmingham and London.—New catalogue dealing with distribution boards and switchgear. For some years the company has devoted a large department to the manufacture of distribution boards of all descriptions, and to meet all requirements. They have now extended this department for the manufacture of enclosed fuses, and are prepared to manufacture fuses to any specification or requirements, and of any capacity. The few lines illustrated in this catalogue of 36 pp., are not to be regarded as the extent of their facilities in this direction. A perusal of the catalogue shows that the company have adapted all their better quality boards for use with the enclosed fuses. The catalogue includes a complete range of distribution boards from a cheap wood case board for ordinary house work, to heavy cast-iron patterns suitable for railways, collieries, &c. List numbers, prices and sizes are tabulated.

Etablissements Aubert-Grenier, Dijon.—Pamphlet relating to the firm's works and exhibit at the Marseilles Electrical Exhibition. They are constructing an underground cable for 40,000 volts A.C., and are carrying out a three-phase system, 10 km. long, at 20,000 volts.

The Armorduct Manufacturing Co., Ltd., Farringdon Avenue, E.C.—Catalogue of 115 pages (with a striking cover) particularising a great variety of electrical accessories, including lamp-holders, ceiling roses, switches, wall-plugs, main switches, measuring instruments, electric light fittings and fixtures, and glass-ware, electric bells and telephones and accessories for same, wireman's tools and sundries, electric fans, &c.

Messrs. C. & E. Layton, 56, Farringdon Street, E.C.—Prospectus concerning the improved arithmometer and the Odhner calculating machine.

For Sale.—Heywood Electricity and Tramways Committee is inviting offers for the purchase of two 60-kw. Reavell-Crompton steam dynamos (500 R.P.M. × 400 to 500 volts). Offers by 28th inst. to Mr. Stott, electrical engineer.

Freehold manufacturing premises. See our advertisement pages in this issue.

LIGHTING and POWER NOTES.

Aberdeen.—It was brought under the notice of the Electricity Committee that the M.D. system of charging for electricity as applied in the city, fell with exceeding severity upon the churches, notwithstanding the easy conditions under which they were supplied. Churches are now to be supplied with energy for lighting purposes at 3d. per unit, instead of having as hitherto to pay the maximum price.

Beckenham.—A L.G.B. inquiry was held on Tuesday into the application of the local authority for sanction to borrow the sum of £1,750 for the purpose of converting the existing incandescent gas street lighting to electricity. It was stated that it was proposed to replace 596 gas lamps with 572 metallic-filament lamps. The present cost of lighting by gas for the number of lamps mentioned was £1,745, and the estimated cost by electricity was £1,482. Experimental metal-filament lamps were found to have more than the estimated average life, the figure being 1,602 hours. The lamps had been kept going night and day from June 16th to September 9th, and in some cases they had lasted 2,070 hours and were still being used. The real average might prove to be longer, and the cost of the lamps themselves would possibly fall in time. They were found to work much better than the gas mantles, for while, in case of the latter, none had been found to start at the nominal candle-power, and all deteriorated, in the case of the electric lamps, the average candle-power for the first 300 hours was 41·9, while for the next 300 hours it had risen to 42·1, and for the 900 hours it was still 42.

Bury.—In the course of his evidence at the recent L.G.B. inquiry, in connection with the Corporation's application to borrow £72,000, Mr. E. J. Watson, the electrical engineer, stated that they had made a canvass of the town with a view to ascertaining the possible power supply business, and found that some 37,544 H.P. was in use. Those who used less than 100 H.P. numbered 80, with an aggregate of 3,308 H.P.; of from 160-250 H.P. there were 27 users, aggregating some 4,576 H.P.; between 250 and 500 H.P., 18 users with 7,465 H.P.; upwards of 500 H.P., aggregate power 22,195 H.P., among 20 users. The above are exclusive of the 145 users of electric motors with some 1,800 H.P. connected. The canvass also showed the great diversity of the trades in the town.

Canada.—Although the Ontario Power Commission is a Government affair, and, therefore, considered unassailable, it has troubles of its own. The position of Toronto, which entered into a contract with the Hydro-Electric Commission, was considered unassailable; yet two injunctions have been taken out and a big legal fight over power has taken place in that city, and Toronto is not a solitary exception. It is claimed in the writs that the City Council had no authority to enter into any contract with the Commission, and it is sought to restrain any action on the by-law. Gainsborough is also objecting to the Hydro-Electric Power line going through the township on the highways, principally because they will have to take 8 ft. off the roadway and 8 ft. of private ground. It is claimed that being a commercial enterprise the line should buy the right-of-way.

Clacton-on-Sea.—A further loan of £1,000 for E.L. purposes has been applied for by the U.D.C.

Continental Notes.—BULGARIA.—La Société d'Electricité de Sofia et de Bulgarie is the name of a new company which has just been formed in Brussels with a capital of £140,000, to acquire and work a concession for the supply of electrical energy for lighting and power purposes in Sofia.

ITALY.—The authorities of the province of Umbria have received an application for a concession to put down a plant to utilise the water-power of the River Nera in the generation of electrical energy for lighting and power purposes in the town of Spoleto.

KOLBERG.—The Town Council has decided to expend £23,000 on a new electric generating station.

GOTTINGEN.—The District Council proposes to utilise the water-power available at Obernjese for a large electric generating station.

KOLSTEIN.—The Kirchbarkan local authorities propose to erect a central station to supply a number of villages in the district with light and power.

FLONHEIM.—£40,000 is to be expended on a central station to supply 18 villages in Rheishessen.

Croydon.—At the B.C. meeting on Monday the E.L. Committee reported the failure of the Weber Concrete and Construction Co. to carry out its contract (for coal bunkers, receiving hopper and constructional steel work at the electric light works) "with due diligence and expedition." It recommended that after tendering seven days' notice in writing to the contractors the work should be placed in other hands. The Committee has a bond with a fidelity company for £500, and, therefore, the Council will sustain no monetary loss.

Dublin.—Councillor Murray has given notice of a motion for the provision of electric street lighting in all streets where mains are laid. The proposal is to adopt Osram lamps in the existing gas standards, which belong to the Corporation, the initial expenditure being 10s. per lamp, and the annual cost £4 per lamp. The proposal affects 1,500 lamps.

The question of electric lighting came up for discussion on September 17th, at the monthly meeting of the Richmond District Asylum, when Mr. H. T. Harris's report on the question was considered at length.

Dundee.—In reply to a request by the Corporation for permission to borrow £60,000 to defray the cost of erecting the new electricity station and sub-stations, the Secretary for Scotland has agreed to the borrowing of £40,000. On Monday night tenders for the building of the sub-station were accepted, amounting to £1,800. The work is to be hurried on.

The Fife Linoleum Co. has decided to have its machinery electrically-driven throughout, the power to be supplied from the Corporation's mains. Supply will also be given for 200 lamps. Mr. Alexander N. Melville, Kirkcaldy, is the contractor for the complete installation.

Felixstowe.—The U.D.C. has held its special meeting relative to the purchase of the electricity undertaking, and a resolution was adopted that conditional on the Council's consulting engineer's estimate for new works to be erected by the Council not exceeding £7,500 (a figure he had previously given), the Council will offer the company £8,000 for the whole of its undertaking and interest in the area.

Heston and Isleworth.—The Electric Lighting Committee of the U.D.C. has for long been troubled with an adverse balance on the revenue fund which, in March last, amounted to £970, and an outstanding debt of £1,908 incurred by the Committee undertaking free wiring and fitting of consumers' premises. As regards the latter, the L.G.B. has refused to sanction a loan for defraying the debt, and with respect to the former the Committee states that the prospects are that the profits for the current year will be but small. Under these circumstances, the matter has been referred to the Finance Committee of the U.D.C. with the request that it will endeavour to find a way out of the difficulty.

Holyhead.—A L.G.B. inquiry was held on September 16th into the application of the U.D.C. for a loan of £3,000 for electric light purposes, the inquiry having been adjourned from last February, owing to certain things not being in order. Included in the loan applied for was £1,216 excess expenditure, and £1,000 for mains and services.

London.—HAMMERSMITH.—The electrical engineer has presented a report with regard to the contract placed with the British Thom on-Houston Co. in July, 1904, for a Curtis turbine, for £9,145, made up as follows:—Turbine £7,272, condenser £1,600, exciter (motor-generator) £273. The machine was first put into commission in September, 1906, and has been in almost constant use since January, 1907, having run 9,118 hours and generated 6,546,210 units during that time. In one or two important details, however, the engineer says that it is not quite in accordance with the specification, viz., noise and overheating, and he does not feel justified in taking it over as it is, and signing the final certificate for £799 10s. In order to overcome both these points, the contractors are prepared to entirely rebuild the alternator free of charge to the Council, and to hand the machine over in accordance with the specification.

The B.C. Electricity and Lighting Committee has resolved that the offer of the British Thomson-Houston Co. to increase the output of the Curtis turbine from 1,500 KW. to 2,000 KW. when they are rebuilding the machine, for £550, and to supply the spare parts required for £136, be accepted.

LAMBETH.—Under an arrangement entered into between the B.C. and the South London Electric Light Corporation, the Council is supplied each year with £1,000 worth of electricity free of charge. The town hall at Brixton is lighted under these gratuitous conditions, but as the hall cannot consume the whole of the electricity due to the Council, the latter has decided to utilise the balance for lighting the South Lambeth public library.

Oldham.—The question of disposing of the old Rhodes Bank generating station was recently discussed by the Electricity Committee. The engineer considered that the new Greenhill station would be overloaded next winter, and that they would require more plant; the matter was left over for particulars to be supplied as to the probable selling value of the Rhodes Bank plant, and the cost of making other alterations.

Scottish Power Developments.—We are informed that the North British Electric Power Syndicate, Ltd., a concern with an influential backing, has completed arrangements with the local Scottish railways for the erection of a power station adjoining the line at Coatbridge, and the laying of the necessary transmission cables along the railways in the neighbourhood, with a view to supplying power to such collieries and works as are accessible over private roads or sidings.

Stoke.—On the 15th inst., Mr. Hooper, L.G.B. inspector, held an inquiry at the Town Hall, into the application of the Corporation for sanction to borrow £15,365 for the Council's electricity undertaking, including the extension of the supply to Fenton. Mr. J. F. C. Snell, consulting electrical engineer, supported the scheme for the supply of Fenton-by-Stoke; he said that the time was not ripe for the concentration of steam plant, and that for some years the present steam stations would have to be continued. Ultimately, he thought a high-tension transmission scheme from one central station to the existing steam stations, using the latter as sub-stations, would be best. The inspector suggested that the amount to be borrowed should be £15,830, to include certain other expenditure. The inquiry was closed.

Swinton and Pendlebury.—The U.D.C. has decided to obtain information regarding the wiring of consumers' premises, the charge for wiring to be included in the price for energy supplied.

Watford.—The U.D.C. has decided that tenders be invited for the extension work necessary to meet the winter's load of 1909-10. At the last meeting of the Council, Mr. Goodrich said he believed the total cost of the work involved would be about £6,000, and would be likely to obviate the necessity of further expenditure until 1912.

West Ham.—At a recent L.G.B. inquiry into the application of the Council for sanction to a loan for the purposes of the electricity undertaking, it was suggested that the Council supplied energy to some of its largest consumers at less than cost price, and certain large ratepayers objected to this. The production of contracts showing the prices charged was requested, and although these prices were offered to be given to the Inspector privately, the officials of the Corporation declined to assent to the production of the particulars publicly. Consequently the Inspector adjourned the inquiry. The town clerk has now submitted to the Electric Lighting and Tramways Committee letters from two of the customers in question, strongly objecting to the terms of their contracts being made public. In this connection the Committee has considered a suggestion by the electrical engineer that the services of an expert should be engaged to examine the contracts with a view to supporting him in his evidence at the adjourned inquiry, and also advising the Committee on the sufficiency or otherwise of the charges made for the supply of current, and has instructed the town clerk and the electrical engineer to engage an expert, and authorised the town clerk to lay the whole position before the L.G.B. should he consider it desirable. A bulk supply for lighting and power combined is to be given to the Lamson Paragon Works at 1½d. per unit net. In reference to the question of meeting the deficiency on the accounts of the electricity undertaking for the year ended March 31st, 1908, the Electric Lighting Committee has decided that the amount of the ascertained deficit be provided for in the rate estimates for the next half-year.

TRAMWAY and RAILWAY NOTES.

Bacup.—The price to be paid for the length of tramways in Bacup has been settled at £10,300, including the cars and engines for that section. Rawtenstall has already purchased for £21,750 the length in its own borough, including the line to Crawshawbooth, and according to present proposals, will work the steam cars up to Bacup until the electrification of the line takes place.

Bournemouth.—A collision occurred between two Corporation cars on the 18th inst., at Tuckton Bridge, fortunately attended with only slight injury to passengers.

Brighton.—The Tramways Committee has resolved that the chairman be authorised to invite the Municipal Tramways Association to hold its annual meeting in 1909 at Brighton, and that the cost of entertaining the delegates at such meeting be charged to the Tramways account.

Canada.—The people of Edmonton, Alberta, have endorsed the purchase of the Strathcona Tramway Co., and the raising of $135,000 debentures to put the entire street car system in operation. There were only seven votes against.

Cardiff.—Mr. Harpur and Mr. Arthur Ellis are to report on the condition of the tramway track and the steps necessary to put it into a safe condition. A long discussion took place on Monday in the Council, and it was admitted that the track was in a bad state.

Continental Notes.—Spain.—A company has just been formed in Brussels with a capital of £40,000, and the title La Société des Tramways Electriqués de Saragossa, to acquire and extend the electric tramway system in the town of Saragossa.

Croydon.—The annual report of the professional auditors to the B.C. presented on Monday, showed a net addition of £1,627 to the tramways fund for the year ended March 31st, bringing the total to £15,418. All ordinary repairs and renewals were borne by revenue, but the auditors were of opinion that the sum first-named "is apparently not an adequate proportionate contribution for future anticipated renewals of the track and rolling stock."

At the same meeting the Tramways Committee brought up a report on the proposed transfer of the undertakings authorised by the Mitcham Light Railways Order, 1901, by the Croydon and District Electric Tramways Act, 1902, and by the Croydon and District Electric Tramways (Extensions) Act, 1903, from the British Electric Traction Co., Ltd., to the South Metropolitan Electric Tramways and Lighting Co., Ltd. The town clerk opposed the transfer, but the B. of T., in a letter dated August 18th, announced that it saw no sufficient reason for withholding its consent to the sale, and had informed the promoters accordingly.

Dundee.—It has been intimated by the B. of T. that that body has no *prima facie* objection to the introduction of the trackless trolley car system by the T.C.

The Tramway Committee discussed the matter on Monday night, when the proposal to experiment with the new system was deferred.

Isle of Man.—An electric car from Douglas collided at Mayhill crossing, Ramsay, with a trap containing visitors, on the 17th inst. The trap was overturned, and eight of the occupants injured.

Leith.—The T.C. has agreed to the proposal of the Tramways Committee to extend the tramway system from Bonnington Terrace to Pier Place *vid* Ferry Road and Granton Road, the expenditure being estimated at £48,000 to £50,000. It will be recollected that about one-third of this route lies in the Edinburgh area, but that that city refused to contribute to the cost of construction. Under the circumstances Treasurer Smith moved that the scheme be curtailed so as to bring the cost down to about £17,000, but his amendment was lost.

Liverpool.—The City Council will meet shortly to consider schemes for the extension of the electric tramway system over six different sections in the city and suburban districts. The most important of these is a proposal to construct an entirely new route through Edge Lane and Broad Green, which will have tracks equivalent to about 4 miles 1,560 yds. in length.

London. — Bermondsey. — The B.C. has received notification from the L.C.C. with regard to the electrification of the Deptford and Greenwich tramways, that the Highways Committee is to recommend the Council to seek, in the 1909 Parliamentary session, specific authority in respect of the route from Tooley Street, *vid* Dockhead, Parker's Row, Jamaica Road, Union Road, Lower Road to Evelyn Street, and for authority to construct five diversions and extensions.

Wandsworth.—The L.C.C. and the B. of T. have been informed that subject to certain conditions, the B.C. will not object to the overhead trolley system of electric traction for the tramways from Hammersmith Broadway over Putney Bridge to Lower Richmond Road, Putney, the construction of which it is proposed to proceed with at an early date. The L.C.C. has written stating that it cannot see its way at present to seek Parliamentary powers for the construction of tramways from Easthill to Putney Bridge, and from High Street to the County boundary at Southfields in accordance with the scheme submitted by the B.C., but that the L.C.C. Highways Committee proposes that Parliamentary powers should be sought for the construction of tramways from York Road, Wandsworth, to Putney Bridge, with single-line diversions. The B.C. Highways Committee strongly objects to the construction of the tramways in Upper Richmond Road, and in the upper part of High Street, Putney, favouring another route.

Lambeth.—The B.C. has decided to support a route for the extension of the tramways from Norwood to the Crystal Palace *vid* Knight's Hill, Crown Hill, High Street, Elder Road, and Westow Hill. Some discussion took place on the possibilities of the route, and a proposal to refer the matter back was defeated.

The Metropolitan and Metropolitan District Railways are increasing the frequency of their services in October. On the Gloucester Road-Mansion House section, the trains will be increased in number from 30 to 34 per hour; in less busy hours the number will be increased from 20 to 26.

It is also proposed to run two ten-car trains, which, however, will have to be divided at Whitechapel, as the platforms further west will not accommodate more than six or seven cars.

A serious accident occurred on the L.C.C. tramways in Old Street, on Sunday last, when a car, the brakes of which are stated to have failed, ran into two preceding stationary cars. The two colliding cars were partly wrecked, and nine passengers received injury, only one, however, sufficiently seriously to be detained in hospital. The tramway service was disorganised for about an hour.

Manchester.—The Tramways Committee at its meeting on Tuesday last (September 22nd) had before it the report of the sub-Committee who had been to Germany to inquire into the trackless systems there in use. The suitability of a trackless scheme for certain kinds of traffic, in and about Manchester, was considered, and the following resolution was passed:—"That the sub-Committee be thanked for their report, and it is recommended that a suitable clause empowering the Corporation to run trackless trolley cars be inserted in the Bill to be promoted by the Corporation in the next session of Parliament." As between tramways and mechanically-propelled vehicles for city traffic, the sub-Committee was strongly in favour of the former.

The foundation stone was laid on the 17th inst. of a new shed on the southern side of Manchester (Princess Road, Moss Side), which will provide accommodation for 250 cars. Of the 6¼ acres purchased from Lord Egerton, 3½ acres will be covered by the shed and the remainder of the land will be left vacant for future extensions.

A new tramway route between Fairfield and Guide Bridge will be opened shortly. It is an important extension, and will connect Openshaw and Fairfield with Denton and Hyde, and also join the Manchester and Stockport car services by way of Reddish and Gorton respectively.

Morecambe.—At a meeting of the T.C. on Monday, the town clerk stated that application had been made for sanction to borrow £7,662 for the purchase of the tramways from the existing company, the appointment of an official referee, and for the granting of a provisional order to work the trams.

Portsmouth.—The T.C. has yielded to pressure from the Milton district, and has decided to extend its electric tramway system through Goldsmith Avenue to Milton. The estimated cost is about £15,000, and it is hoped that the B. of T. and the L.G.B. will give their sanction to the work being carried out at once, so

that remunerative employment may be provided for the unemployed during the winter months.

Preston.—In the report on the working of the tramways for the year ended March 31st last, the general manager, Mr. J. F. Simpson, states that the total income was £38,762, the working expenses £22,961, and the gross profit £15,801. After providing for capital charges, £11,406, and other items, there was a balance towards reserve fund of £3,194.

Rawtenstall.—In two or three weeks it is expected the electric generating station at Hareholm will be roofed in. The necessary machinery is now ready to be placed in position. As soon as possession is taken of the tramways the work of electrification will be commenced in Bacup Road, and the contract for laying the line should be finished in four months.

Teddington and Hampton Wick. — The London United Tramways Co. is applying for a B. of T. order to increase the limit of speed on the Kingston Road from 8 to 12 miles per hour. The B. of T. has requested the Hampton Wick and Teddington U.D.C.'s to attend and give their views, and the latter Council has decided to oppose the application unless the company agrees to an arrangement limiting the number of empty cars run from the Surrey district to the depôt at Fulwell each night.

Victoria.—The preliminary report, by Mr. C. H. Merz, on the electrification of the Melbourne Suburban Railways has been referred to recently in these columns; Mr. Merz contends that electrification will permit of a more frequent service, combined with the shortening of existing journey times by 15 to 30 per cent. For example, journeys at present occupying 38½ and 21 minutes would be shortened to 31 and 17 minutes respectively, and on routes where 40 and 28 trains a day are now provided, 75 and 73 respectively could be operated with electric traction. The work should be carried out in three stages as follows:—(1) The Port Melbourne, St. Kilda, Sandringham, and Broad Meadows branches, 29 miles in length. (2) The Camberwell and Williamstown branches, 36 miles in length. (3) The Sunshine, Coburg, Preston, Heilelberg, Dandchong, and Mordialloc branches, 59 miles in length. The total route length is thus 124 miles, and Mr. Merz considers it advisable only to convert the lines in stage 1 at first, and financially inadvisable to convert less at the start. For the conversion of the entire system the capital expenditure is estimated at £2,227,050. Train-mile expenses with electric traction are estimated at 11d., as against 18 9d. with steam, although the train-mileage would be increased with electrical operation. It is estimated that if the whole suburban service were electrically-worked there would be an annual saving of £27,267 on operating expenditure. Including 4 per cent. on the capital cost, the total annual expenditure would actually amount to £44,791 more than at present, but against this figure must be set off the additional revenue from the improved services. It is thus estimated that the surplus, after paying interest on the new capital required, would be £40,251 in excess of that obtained with steam traction in 1906. By adopting the multiple-unit system of electric traction, the train-mileage can be increased by 71 per cent., with an increase of only 23 per cent. in the ton-mileage. It is recommended that cross-compartment coaches and not corridor cars be adopted, the existing stock being used for the purpose. At present 546 coaches and 110 locomotives are used, and with electrical traction only 496 cars would be required, the saving being due to the higher speed attainable. For operating, direct-current at 800 volts, distributed from sub-stations to a protected conductor rail, is recommended; the sub-stations would be supplied with three-phase H.T. current from the power station by underground cables in the central areas, and overhead lines in the less populous districts. A central power station at Yarraville could handle the load of 35,000 E.H.P., the plant to consist of water-tube boilers and steam turbines. This power station could also drive the St. Kilda tramway, in addition to lighting the railway stations and supplying energy to the railway workshops. Should electric traction be decided on, the expenditure on the initial instalment of conversion, including generating plant, would amount to £801,830, from which the surplus, after meeting interest charges, would be £21,356 more than obtained with steam working in 1906. Should steam be retained on these lines, the traffic increases would necessitate an expenditure of £141,019 on rolling stock alone.

West Fife.—A tramway scheme for Dunfermline and district is likely to be proceeded with in the course of the next three months. The Fife Electric Power Co. is to supply the necessary power, and to provide this, the generating plant is to be immediately enlarged.

TELEGRAPH and TELEPHONE NOTES.

Imperial Telegraphic News.—The Canadian Parliament has appropriated $24,000 for the purpose of maintaining an independent and efficient service of telegraphic news from Great Britain for publication in the Canadian Press. The *Telegraph Age* also states that the appropriation is to last until July 1st, 1910, and is to be paid to an association or committee representing the proprietors of such newspapers as associate themselves for the purpose of maintaining such service. No payment will be made, however, until the Minister of Finance has satisfied himself that the benefits of the service are open, on fair and reasonable terms, to all newspapers published in Canada, and that not less than one-half the cost of maintaining the service is paid by the proprietors of the newspapers participating in those benefits.

Paris Telephone Fire.—On Sunday night last a fire occurred at the Central Exchange of the Paris telephone system, which resulted in the complete breakdown of the service. The fire originated in the basement of the building, between 7 and 8 p.m., and in spite of the utmost endeavours of the Fire Brigade, it rapidly extended to every floor, finally breaking through the roof. It was feared that the General Post Office, which adjoins the Exchange, would be involved, but thanks to the concentrated efforts of the firemen this crowning disaster was averted. The account books of the exchange and part of the interurban switchboard alone escaped destruction. The damage is estimated at £800,000, and it will be many weeks before the normal state of things can be restored. Not only was the local service in the business centre of the city completely interrupted, some 19,000 subscribers being cut off, but also telephonic communication with London and the large French cities was stopped, and the telegraph service was disorganised, as a number of trunk wires passing through the basement of the Exchange were destroyed. The pneumatic tube service and express messengers were requisitioned by the public to replace the lost telephone service as far as possible. Every effort was made to connect up the subscribers to local exchanges as quickly as possible. The telephone staff escaped from the building without difficulty before the fire had attained to grave dimensions. The cause of the fire is said to have been a short-circuit in the wiring of the basement, where repairs had been in progress. During this month a common-battery switchboard had been installed in the exchange, and it appears that several short-circuits occurred on Sunday and were put right before the fatal ignition took place; when the fire once got hold it progressed with extraordinary rapidity and violence. The building was a four-storey structure, measuring about 500 ft. × 160 ft. in plan.

Telephone Agreements.—Last week the National Telephone Co., Ltd., was sued by Mr. P. H. Edwards, Earl's Court, for damages for alleged improper disconnection. The evidence showed that the plaintiff's deposit for calls was exhausted, and as he did not renew it at the request of the company, the telephone at his private house was disconnected for a week. Judge Rentoul gave judgment for the company, with costs, remarking that though the plaintiff might think the wording of the contract harsh, he was a solicitor, had entered into the contract, and was bound by its terms.

Wireless Telegraphy.—On Thursday last week a demonstration of typewriting by wireless telegraphy was given at the Hotel Cecil by Mr. Hans Knudsen, the inventor of the system. The method adopted involves perfect synchronism between the sending and receiving apparatus; this having been attained, the transmission is effected by means of travelling contacts at either end of the system, a set of keys at the sending end, and a corresponding set of coherers and relay circuits at the receiving end in connection with a typewriter. At the moment when any particular key is pressed at the sending end, only the corresponding circuit is closed at the receiving end, and, therefore, only that circuit can respond. Thus, so long as perfect synchronism is maintained, and the speed of the travelling contacts is sufficiently great, a typewriter or type-setting machine can be actuated from a distance by telegraphy, wireless or otherwise. The principle of distributive telegraphy is well known, but its application to wireless telegraphy appears to be novel.

In addition to the wireless telegraph station which is being established at Göttingen, says the *Times* Berlin correspondent, it is proposed to erect stations at Cologne and at Königsberg.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—ADELAIDE.—November 20th. The City Council requires tenders for the supply and erection, complete, of a refuse destructor, electric lighting plant for same, &c. Particulars may be obtained from the Agent-General for South Australia, 1, Crosby Square, Bishopsgate Street Within, E.C.

TASMANIA.—November 2nd. Tenders will be received at the office of the Deputy Postmaster-General, Hobart, for the supply and delivery at Hobart of material for accumulator equipment for telegraph purposes. Tender forms, specifications, &c., may be seen at this office.

SOUTH AUSTRALIA.—October 21st. Tenders will be received at the office of the Deputy Postmaster-General, Adelaide, for a power plant for charging accumulators for telegraph purposes at the General Post Office, Adelaide, as per specification No. 228. Specifications can be seen at this office.

MELBOURNE.—The Postmaster-General of the Commonwealth requires tenders for the supply and erection of installations for wireless telegraphy at the following places:—Launceston; King Island (Bass Straits); Flinders Island (Furneaux group); Melbourne. See "Official Notices" September 18th.

MELBOURNE.—October 19th. The Commonwealth Postmaster-General requires tenders for four complete sets of instruments (signalling and protecting) necessary for direct duplex cable working.

TASMANIA.—March 15th, 1909. Postmaster-General. Telephone switchboard, common battery system and apparatus for use at subscribers' premises, Launceston.

MELBOURNE.—October 13th. 770 electricity recording meters and 157 maximum demand indicators, for the Council. See "Official Notices" to-day.

(*Continued on page* 503.)

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A MANCHESTER ELECTRICAL WORKS.

[THE WORKS OF ELECTROMOTORS, LTD., AT OPENSHAW.]

There has had to be a good deal written during the last few years concerning the state of the electrical industry. Perhaps it had been better had some things been left unsaid.

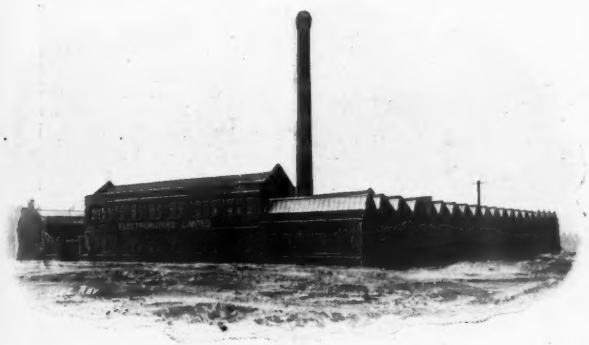

Fig. 1.—General View of the Works of Electromotors, Ltd., Openshaw, Manchester.

Anyhow, in forming our opinion concerning the views expressed, and the credence that should be extended to them, we have come to the conclusion that, generally speaking, the doleful scribes have judged the position of the electrical industry from the experience that they have been passing through in their own particular businesses. Because their trade has gone to the dogs, they take it that all trade has passed the same way. Now one has only to get out among the British electrical factories in certain districts to find that the complaint of bad electrical trade is by no means universal. We have so gone ourselves, and while we find that in certain heavier directions business has fallen away, there are other departments where activity was never so gratifying, and where factories and works have had recently to be extended to keep pace with incoming orders booked at good prices. Sometimes this sort of thing is experienced by makers of specialities, but it is an experience not limited to these, for we have witnessed it in works devoted to standard lines of manufactures.

Among the "live" works that we have recently had the pleasure of visiting are those of Messrs. Electromotors, Ltd., at Openshaw, Manchester. We visited these same premises, or, to be more correct, we ought to say that part of them that then existed, some seven years ago, and we then formed an impression which we expressed in our pages at the time, that the company would have a successful career. Seven years is a sufficiently long period to have elapsed to enable us to form a fair idea concerning the accuracy or otherwise of our forecast. Our investigation of the position of affairs, made under the guidance of Mr. Ben. Longbottom, the general manager of the company, and our tour of the

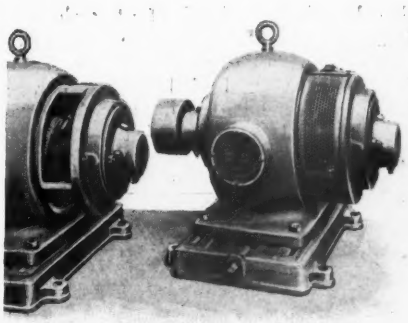

Fig. 2.—Original Standard Semi-Enclosed Motor (from 1 to 20 H.P.) as at present Manufactured.

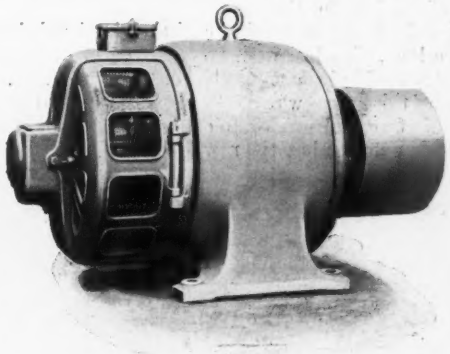

Fig. 3.—Extended Range of Semi-Enclosed Motors from 20 to 50 H.P.

Fig. 4.—Heavy Machine Bay.

different departments of the works made under his pilotage, combined to convince us that in our judgment passed in the year 1901 we did not err. The company has its electric motors in all parts of the world, doing every conceivable operation for which their size adapts them, it has been paying dividends for the past six years, has depreciated its plant and patterns with wise generosity, has built up its reserves substantially, and what is probably the best feature of all, and one which has made these other things possible, it has extended its operations very considerably, doubling its turnover, without increasing its capital account. Instead of dividing its profits up to the hilt in the shape of dividend, these have been invested again in the extension of operations, increasing the value of the works and business without adding to the Co.'s nominal capital. The value is, therefore, left in the undertaking without nominal capital obligations being altered in the least. We believe that some electrical companies in this country would give much to be able to say the same. It is no unusual thing for new uncertain departments, and new lines of manufacture, to be added to old ones, which, by themselves, proved profitable, but the new operations required additional capital and did not soon produce a commensurate revenue, so that the ratio of profit on the whole capital was far less than it originally was on the smaller amount. Everybody will recognise that it is a far sounder and wiser policy, where it can be adopted, for the capital account to be kept low, for low dividends to be paid in order to keep it so.

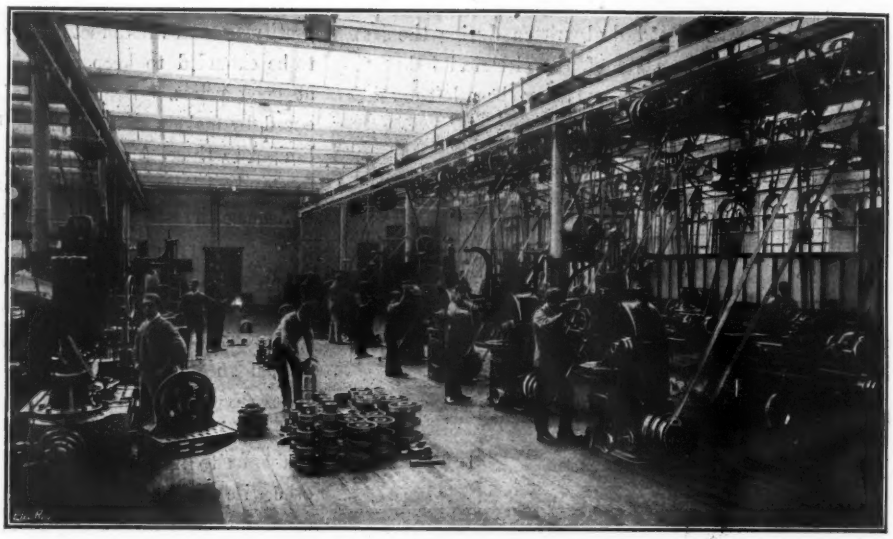

Fig. 5.—Vertical Boring Mill and Drilling Machine Bay.

The promoter or investor who seeks only for a favourable opportunity to sell out his interest in a concern wants his dividend high early, because a bird in the hand is worth two in the bush, and because high dividends generally make high selling prices for shares. But where a company is in the hands of a few who mean to stand by it, the fact that dividends are low in the early stages is a small matter if they can feel that they are multiplying the value of the security behind their capital, and are at the same time increasing the future dividend probabilities.

If we remark that Electromotors, Ltd., have stuck to their original speciality, we must not be understood to suggest that they have rested upon their oars. While it is true that this speciality consisted of dynamos and motors from 1 to 20 H.P., it is also to be noted that they have worked every possible application of this speciality; for instance, in the motor branches they have watched over such matters as complete power installations, motor-driven pumps, fans, lifting and haulage gears, domestic specialities, &c., while in dynamos they have been producing motor-generators, balancers, &c., steam dynamos, petrol sets, &c.

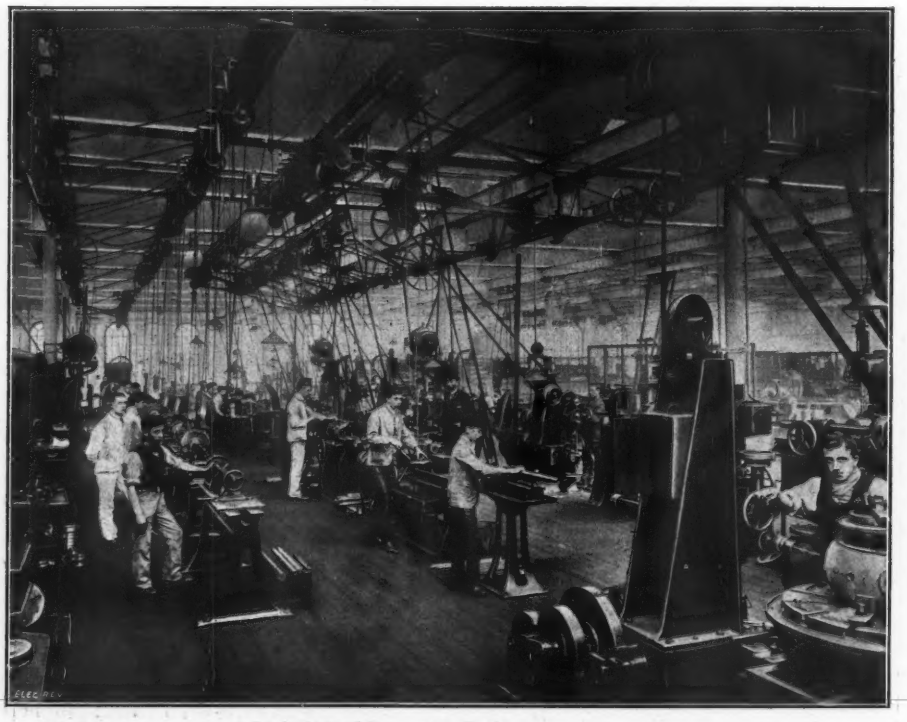

Fig. 6.—Light Machine Tool Bay.

The present satisfactory position of the company, then, may be attributed to four things: (1) Its having devoted itself assiduously to the production of a good machine of a specified range of sizes; (2) its extensive use of labour-saving machinery; (3) an admirable system of works organisation under the management and control of a man whose heart is in the business; (4) the cautious enthusiasm (if we may so describe it) of this same gentleman, coupled with his watchfulness of the world's markets, his care in planning a course,

and the determination with which he devotes himself to following it. Mr. Longbottom believes in his motor and he believes in himself—which two things, coupled to his company's policy of proceeding surely, though slowly, have established Electromotors, Ltd., in the position that they now occupy.

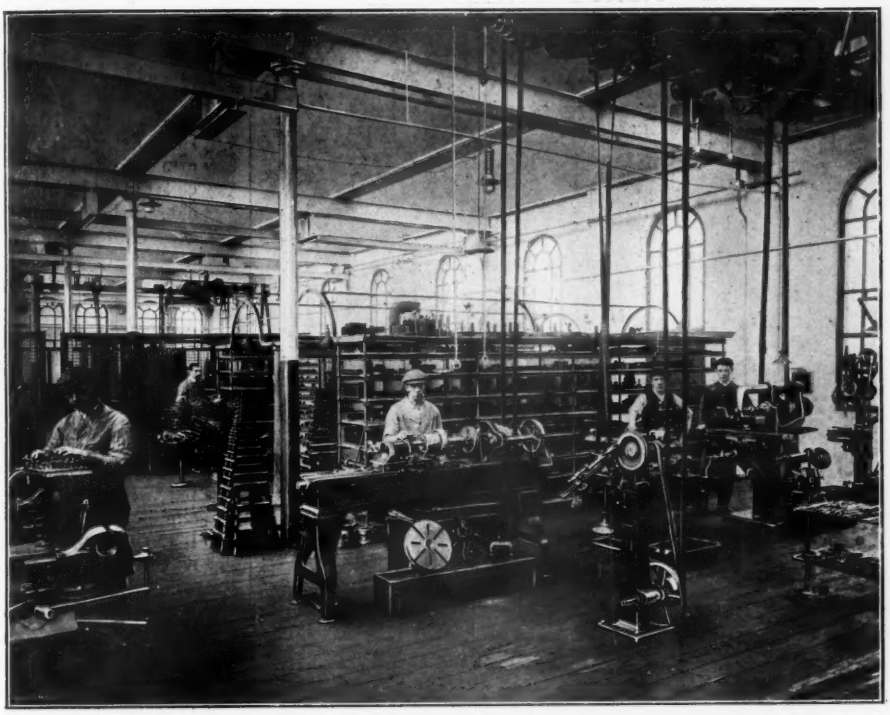

Fig. 7.—Tool Room, showing Tool and Jig Racks.

We have sometimes alluded to the necessity which exists for putting an end to the present-day price-cutting in certain branches of our manufacturing industries. This difficulty Electromotors, Ltd., have, of course, had to face, and they have been able to meet it satisfactorily because of securing a very largely increased turnover, while, as we have pointed out, the capital account remained unaltered. If the output had but equalled a turnover of the capital once a year—which we believed to be the normal state of things in an engineering works—it is doubtful whether there would have been any profit earned by the company during the past three years. All of which statements seem to us to point to the fact that it is possible to manufacture at competitive prices, and with profit, if a cautious financial policy be adopted, and if enlightened management be unceasingly at the helm.

Fig. 8.—Erecting Bay, looking West.

Turning now to the works, we give views of the principal departments at the works as they stand to-day. The first point which strikes the visitor is the system of transportation and the absence of "work in progress" on the shop floor. The motor bodies pass from the casting stores, which is a separate building connected by a tramway, to the various machine tools without cessation, and as soon as completed they are stored in an allotted space away from the machine bays and within easy reach of the erecting bays. The finished light parts are collected daily from the machines by the testing department and pass through to the finished stores. The result is an entire absence of that confusion, arising from the accumulation of finished and unfinished parts in the midst of the workmen, so prevalent in many engineering works. This is well illustrated in figs. 4 and 5, which are photographs of the heavy machine bay and the vertical boring mill and drilling machine bay. As these bays are fed by overhead travelling cranes the ease of transport can be readily understood. The vertical mills play an important part in the manufacture of the firm's product, and this has been rendered possible by a fine system of chucks, jigs and gauges, which entirely transfer the responsibility for accuracy from the operators to the tool room.

Fig 6 shows the light machine tool bay which comprises the usual complement of lathes, automatics, and grinding machines, &c.

Fig. 7 illustrates the tool room, which is undoubtedly the mainspring of the works. The photograph only shows a few

of the machine tools in this department, but it gives a good idea of the system of storing in the large rack space taken up by the chucks, gauges, &c. This department is entirely self-supporting, and devotes the whole of its time to the making and keeping in order of the tools required by the works. There is not a part, however small, of a standard machine that has not got its full complement of chucks, gauges and special tools.

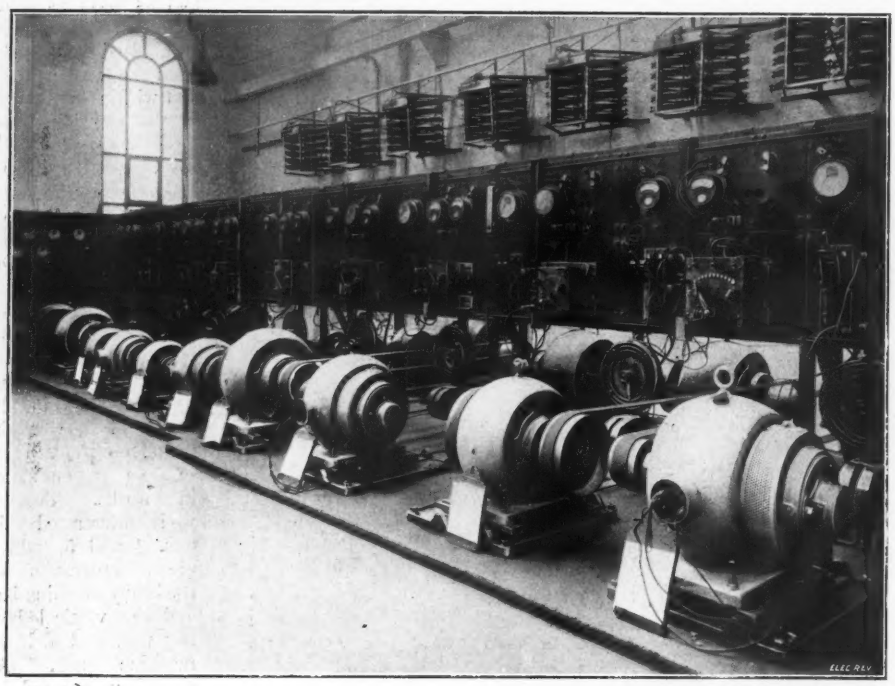

Fig. 9.—Test Bed for Machines from 2 to 20 H.P.

One of the erecting bays is well illustrated in fig. 8, and it is worthy of note that the customer is only taken into actual consideration from a works manufacturing point of view for the first time in that portion of the works shown most clearly in this view.

The portion of the test room illustrated in fig. 9 shows the arrangement for testing motors from 2 to 20 H.P. Behind the switchboard a range of permanent machines are provided, and in front, mounted on adjustable bedplates, are the machines to be tested. The machines are either belted across on the "Hopkinson" system, or the current generated in the permanent machine is absorbed in the resistances fixed on the wall at the back of the switchboard. The switchboard is so arranged that by a system of plugging any machine to be tested can have its required voltage by means of a balancing motor-generator system in the engine room.

It is of interest to note at this stage that although the works, as a usual thing, are driven and lighted from their own generating plant, a stand-by system involving a fine switchboard has been arranged with the Manchester Corporation, which will effectually prevent any delay through breakdown, and is most economical for the working of overtime.

The girls' section of the winding room is shown in fig. 10. In this department the armature and magnet coils are made throughout, and the smaller sizes of armatures are connected up. The winding and soldering of armatures and the connecting up of the heavier sizes, are carried out in the men's department in the adjoining room.

The system of storekeeping is worthy of note, if only for its simplicity. In every bin, shelf and drawer a card is provided, which indicates at any moment the exact stock of the parts in that bin. When an order comes through for material, the number of parts taken away is subtracted, and the result is jotted down with the date on the card. By an arrangement of maximum and minimum stock, a sufficient supply can thus be maintained, and stock-taking becomes simplicity itself.

Another detail of organisation for the getting-out of stores and tools has materially aided production in the works, and is, as far as we know, unique. In the tool room and in the stores are fixed electric bells with an indicator system. The desk of every leading hand in the works is connected up with the respective indicators. When a leading hand

Fig. 10.—Portion of the Winding Room (Girls' Department).

requires anything he rings through to the stores, from whence a messenger is immediately sent for his order and he delivers the material as, and when, required.

Sundry stores, such as waste, chalk, &c., are kept by the leading hands for their respective departments, thus avoiding unnecessary journeys. When it is taken into account that any machine tool can not only be fed with its raw material, but that the necessary special tools and gauges for the job are delivered almost simultaneously, the advantage of the system will be readily understood. Then there is the entire absence of men leaving their benches or machines and hanging about the window of the tool-room or stores, always an objectionable feature.

Space forbids our illustrating the casting stores, pattern shop, paint room, drying room and finished machine stores, which go to make up the works.

We understand the company will be shortly putting on the market an extended range of machines, which they will limit at 50 H.P. This extension in manufactures coincides with a recent works extension, and as the existing plant is of sufficient capacity to cope with the new sizes, a full complement of work can be expected.

We venture to believe that a visit to these works at Openshaw would well repay electrical engineers who are attending in Manchester during the run of the Electrical Exhibition. The excellence of their equipment and organisation cannot do other than make a good impression upon the minds of those who know anything about the manufacturing methods which obtain in connection with the electrical industry of this country.

CONTRACTS OPEN.

(Continued from page 498.)

Belgium.—October 2nd. The municipal authorities of Malines are inviting tenders for the concession for the supply of electricity in the town for lighting and power purposes. Particulars may be obtained from, and tenders are to be sent to, Le Collège Echevinal, Hôtel de Ville, Malines.

Birmingham.—October 1st. 60,000 tons of coal, for the Corporation generating stations. Tenders to R. A. Chattock, city electrical engineer and manager.

Constantinople.—The Post and Telegraph Department requires tenders for 8,500 miles 4 mm. steel wire, 15,000 Leclanché insulators, and 1,360 other insulators. A deposit of 10 per cent. is to be made by a local agent.

Egypt.—October 29th. The Ministry of the Interior wants tenders for the installation of electric lighting in the town of Zagazig, in accordance with specifications and plans that may be inspected at the offices of the above Ministry at Cairo.

France.—PARIS.—October 3rd. The Under-Secretary for Posts and Telegraphs, 13, Rue de Grenelle, Paris, invites tenders for a multiple switchboard for the Central Telephone Station, Rue des Archives. (This announcement was given out before the fire occurred on Sunday, which will, of course, necessitate the purchase of further plant.)

October 13th.—Multiple switchboard for the central exchange, Paris. Apply to the Sous-Secretariat d'Etat des Postes et des Télégraphes, Rue de Grenelle, 103, Paris, before October 3rd.

Germany.—The municipal authorities of Drembach have decided on the establishment of a central electric lighting station in the town, and are about to invite tenders for the erection and equipment of the same.

Great and Little Usworth.—Poles, &c., for public lighting by electricity. J. R. Elliott, clerk to the Parish Council, Fern House, New Washington, Co. Durham.

Halifax.—September 29th. Electrical fittings for six months for the B.G. A. T. Longbotham, Clerk, 4, Carlton Street, Halifax.

Limerick.—October 2nd. Two additional switchboard panels for the E.L. Committee. See "Official Notices" to-day.

London.—October 13th. Six fuel economisers, 320 tubes each; three electrically-driven feed pumps, 9,000 gals. per hour each; and two 5,000-KW. horizontal steam turbo-generators, for the L.C.C. See "Official Notices" September 18th.

October 5th.—The Metropolitan Railway Co. invites tenders for general stores for one year, including electric wires and cables, also electric lamps, carbons, fuses, ebonite, battery jars, zincs, &c. Tenders to Secretary, R. H. Selbie, 32, Westbourne Terrace, W.

Mountain Ash.—October 5th. Sub-station at Ynysybwl, switchgear, transforming apparatus and overhead distributing mains for the U.D.C. B. J. Day, consulting engineer, 3, Park Place, Cardiff.

Salford.—October 5th. Electric wiring of the Halton Bank Council School, Pendleton, for the Salford Education Committee.

September 28th.—Installation of a sprinkler system at Frederick Road car depôt, Pendleton, for the T.C. General Manager, Tramways Department, 32, Blackfriars Street, Salford.

Saltley.—September 25th. Three-phase induction motor (200 H.P.) for direct coupling to a centrifugal pump for the Birmingham, Tame and Rea District Drainage Board. See "Official Notices" September 18th.

Spain.—October 10th. The municipal authorities of San Mateo (province of Castellon) are inviting tenders for the concession for the electric lighting of the town during a period of 10 years. Conditions may be obtained from, and tenders are to be sent to, El Secretario del Ayuntamiento de San Mateo (Castellon).

War Office.—Stores, &c. See "Official Notices" to-day.

Warrington.—October 7th. Flame arc lamps for the Corporation. See "Official Notices" to-day.

Watford.—October 6th. 500-KW. turbo-alternator, surface condenser, switchboard panel, economiser and high-speed fan engine for the U.D.C. See "Official Notices" September 18th.

CLOSED.

Australasia.—HOBART (TASMANIA).—Postmaster-General's department:—

200 common battery wall telephones, £417 10s.—International Electric Co. London.
Material for extension of common battery switchboard.—Western Electric Co.
800 double-pole receivers and cords, £196 13s. 4d.—North Electric Co. (Ohio)

MELBOURNE.—Commonwealth Postmaster-General. 173 tons sulphate of copper, £4,306 5s.—Wallaroo and Moonta Mining and Smelting Co., Adelaide.

Belgium.—La Société des Constructions Electriques de Charleroi has secured a contract for the installation of an electric generating plant at the collieries of the Noel-Sart-Culpart Co. The current will be utilised not only for lighting purposes, but also for operating the winding engines, the coal-washing machinery, and the ventilating plant.

Canada.—The Hydro-Electric Power Commission has accepted the tender of F. H. M'Grogan Construction Co. for the building of some 300 miles of thin transmission lines in South-Western Ontario. He will have associated with him the firm of Smith (C. B.), Kerry & Chase.

Cape Town.—The tender of Messrs. Green & Trevett, electrical engineers, has been accepted for the supply and erection of a complete electric lighting plant at the Boarding Department of the Bloemhof Girls' Seminary, Stellenbosch. The installation comprises petrol engine, dynamo, accumulators, and wiring for lights; also an electric bell system.

Finchley.—The D.C. has accepted the tender of Messrs. Whipp & Bourne, at £336 10s., for switchgear extensions.

Hastings.—The Electricity Committee has given a contract for coal for six months to the Medway Coal Co.—Bwllfa No. 1 large smokeless, at 23s. 6d. per ton.

Manchester.—The tender of the Tudor Accumulator Co., Ltd., has been accepted by the Corporation, for a battery to give 1,000 amperes for one hour.

Messrs. A. Reyrolle & Co. have received from the Corporation the contract for two years' supply for semi-enclosed and totally-enclosed motor-starters of 15, 20 and 30 H.P. The contract is for their "Wait on the first Stop until the Motor starts" type.

Rawtenstall.—The T.C. has accepted the tender of Messrs. Whipp & Bourne for station lighting and wiring to motors; that of Messrs. Bertram Thomas, for testing instruments and accessories and tools; and that of the United Electric Car Co., Ltd., for the supply of tramcars, including compensating springs and Raworth's regenerative control system. There will be 16 cars fitted with Westinghouse motors. We believe that this is the first instance of a line being completely equipped with regenerative motors.

Watford.—The U.D.C. has accepted the following tenders:—

Worthington Pump Co.—Condensing plant, £630.
L. R. Ensor.—Extension of cooling water supply, £696.
Babcock & Wilcox, Ltd.—Superheaters to boilers, £360; links for stoker, £38.

CONTRACTORS' COLUMN.

[The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate, but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large, this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

ABERDEEN.—Office at South Market Street for J. Wilson, blacksmith; J. M. Wilson, architect, Aberdeen. Additions to fish-curing premises at Palmerstone Road, for J. Brodie; J. Park, builder, Aberdeen.

ABERYSTWYTH.—New elementary school buildings at Aberystwyth. D. Lewis, architect, North Parade, Aberystwyth.

ALDENHAM (Herts.).—Additions to Yersin Laboratory, for Bailey & Sons.

AMBLE (Northumberland).—New school (£3,000). Northumberland C.C.

AMERSHAM.—Three houses at Chesham Bois, three at Chalfont St. Peter, and one at Great Missenden.

AMMANFORD (Carmarthenshire).—Proposed new Y.M.C.A. premises (£2,500).

ASCOT.—Parish room for South Ascot.

ASHBOURNE (Derbyshire).—Proposed new sewage disposal works. Ashbourne District Council.

ASHBY-DE-LA-ZOUCH.—House, Leicester Road, for J. F. Tyler.

BARNET.—Alterations, Alexandra beer-house in Wood Street: coal and wax store at Alston Works.

BARNSLEY.—Extension at the Beckett Hospital. R. & W. Dixon, architects, 5, Eastgate, Barnsley.

BELFAST.—New church for St. Simon's parish in contemplation.

BENTHAM (Lancs.).—New County School at Low Bentham. Cumberland Bros., builders.

BERKHAMSTEAD (Herts.).—Adapting premises in High Street for Council offices, &c. (£1,000). E. H. Adey, surveyor, District Council.

BIDEFORD.—Wesleyan Methodist Church, class-rooms, &c., at Alverdiscott. W. J. Copp, architect, Strawberry Cottage, Meddon Street, Bideford.

BIRMINGHAM.—Small-pox hospital buildings at Lower Hasbury. H. E. Folkes, architect, Waterfoot Buildings, Stourbridge.

BISHOP AUCKLAND.—Wesleyan Methodist Sunday Schools at Evenwood (£800); J. Guthrie & Son, builders, Corporation Road, Darlington. Secondary school for Durham C.C.; Architect to the Education Committee, Shire Hall, Durham.

BLACKPOOL.—Central public library in Queen Street and Maybell Avenue. T. Loftus, town clerk, Town Hall, Blackpool.

BLAIRGOWRIE.—Alterations at malt kilns for Panton & Co., Mill Street New business premises in High Street, for Miss J. B. Grieve; Mr. Bruce, builder, Coupar Angus.

BODMIN.—Proposed new offices for the Cornwall C.C. C. L. Cowlard, clerk to the County Council, Bodmin.

BOLTON.—New United Methodist Sunday School at Black Moss.

New central post office. Post Office Works Department, Westminster, London, S.W.

BOURNEMOUTH (Winton).—Extension of the Winton Wesleyan Methodist Church. F. Ling, architect, Winton; A. J. Long, builder, Winton.

BRAY (Ireland).—Proposed new free library in Eglinton and Florence Roads (£2,000). Mr. Wilmot, architect, Bray.

BRIERLEY (near Barnsley).—Two houses. P. A. Hinchcliffe, architect, 14, Regent Street, Barnsley.

BROADSTAIRS.—Additions to Selwyn House, St. Peter's Road, for A. G. Price; additions to Marriott Villa, Church Street, St. Peter's, for D. Cox; houses, St. Peter's Park Road, for W. Clements; St. Peter's Park Road, for E. G. Holbourn, builder, St. George's Road; proposed public lift, G. Graham-Tucker, architect, 1, York Terrace, West Cliff, Ramsgate.

BROMLEY.—Additions to Broadway House, High Street, for Levens, Son and Hoare, auctioneers, &c. Additions to Orchard-Combe, Orchard Road; T. Crossley & Son, builders, 68a, Tweedy Road, Bromley. Additions to Napier Factory, Napier Road; Fry & Willson, 125, Mason's Hill, Bromley. Additions to The Vron, Orchard Road, for Wheatley & Duncanson. Stables, &c., Copley Dene, Sundridge Avenue; J. Podger & Sons, builders, 47, College Road, Bromley.

BUDE.—Dwelling house. Mr. Barclay Bevan, Bude.

BURTON-ON-TRENT.—New police-station, superintendent's house and Court House, for the T.C. H. Beck, architect, 10, High Street, Burton-on-Trent.

BUSHEY (Herts.).—Houses, Merry Hill, Mount Road, for W. Bridges; alterations and additions to laundry, Glenoce Road, for A. J. Gurney.

CAERAU (Glam.).—Welsh Calvinistic Methodist Chapel (£2,500).

CAMBORNE.—New United Methodist Church (£2,500). S. Hill, architect, Green Lane, Redruth; Mitchell & Bond, builders, Camborne.

(Troon).—Proposed Wesleyan Church at Plantation, near Troon. S. Hill, architect, Green Lane, Redruth.

CARLISLE.—Proposed church house (£4,500); Dean of Carlisle. Railway mission hall, East Tower Street; Archibald Gibson, Paisley.

CHELMSFORD (Pleshey).—House of Rest (£2,000); chapel proposed to be added later (£1,000). Rev. C. W. Howis, vicar of Pleshey, honorary chaplain.

CHELTENHAM.—Proposed extension of the General Hospital. Jas. Villar, architect, Cheltenham.

CHESTERFIELD.—Alteration to the Stephenson Memorial Hall. Borough Surveyor, Saltergate, Chesterfield.

CHINGFORD.—Ten houses, T. West, builder, Highams Park; 14 houses, T. and W. Baker, builders, 106, Selwyn Avenue, Walthamstow.

CHOPWELL (Co. Durham).—New church of St. John the Evangelist (£2,000). Mr. Gowland, architect, Chopwell; Hicks & Charlewood, builders, Newcastle-on-Tyne.

CHORLEY.—Sewerage scheme (£11,000). Borough Surveyor.

COLCHESTER.—Extension of Colchester Royal Grammar School. Newman, Jacques & Round, architects, 2, Fen Court, London, E.C.

CORK.—Proposed technical school in the Corn Market. Chairman, Borough Education Committee.

CRAMLINGTON (Northumberland).—Elementary school (£9,000). Northumberland C.C.

CREWE.—Contemplated extension of Hightown Schools. Crewe Education Committee.

CROYDON.—Additions to the infirm block and new children's home at the workhouse, and additions to the workhouse, Queen's Road; A. Berney, architect, 104, George Street, Croydon. New street, Rake Lodge Estate; J. P. Oldaker, estate agent, Woburn Lodge, Purley. Additions Isolation Hospital (£7,500); R. M. Chart, surveyor, Rural District Council.

DARTFORD.—Houses, Gladstone Road, for H. Mitchell; conversion of premises into house, 96, Lowfield Street, for G. Williams.

DATCHWORTH (Herts.).—New Baptist Church at Burnham Green.

DENTON.—Houses, Market Street, for H. Carlisle; Apsley Road, for Ernest Richardson; Haughton, Green Road, for Jacob Worth; additions to Royal Laundry, Frederick Street, for Alfred Dagnall.

DUBLIN.—Proposed alterations and extensions to Portrane and Richmond Asylums (£35,000). G. T. Moore, architect, Dublin.

DUNDEE.—Baths, reconstruction and extension scheme (£10,000). J. Thomson, city engineer.

DURHAM.—Alterations and improvements at Flint Hill, Marley Hill Colliery, Croxdale, and Hetton Girls' and Infants' Council Schools. F. E. Coates, architect, Shire Hall, Durham.

New Primitive Methodist Church at Bowburn.

EASTBOURNE.—Alterations to laundry at the Borough Sanatorium. A. E. Prescott, Borough Surveyor, Town Hall, Eastbourne.

EXETER.—New buildings in connection with Hele's School; C. E. Ware and Son, architects, Exeter. Detached house, Athelstan Road, The Barnfield; J. A. Lucas, architect, Guildhall Chambers, Exeter.

FARNWORTH (Bolton).—Sixteen houses, Campbell Street, J. Cocker, builder, Walkden; four houses, Plodder Lane, J. and J. Shaw; 10 houses, Bradford Street, D. Partington, Worsley Road, Farnworth.

FAVERSHAM.—Extensive alterations to premises, for F. W. Philpott, jeweller, 23, Preston Street.

FERRYBRIDGE (Yorks.).—Houses for Till and Watson.

FERRYHILL (Co. Durham).—Hall for the Dean Bank and Ferryhill Literary and Social Institute. J. H. Nicholls, architect, 18, Fawcett Street, Sunderland.

FINDOCHTY (Banffshire).—New schools. R. B. Pratt, architect, County Bank House, Elgin.

FLINT.—New works for the British Clanstaff Manufacturing Co.

GILLINGHAM (Kent).—Parochial hall in connection with St. John's Mission, Twydall.

GLASGOW.—Offices in Logan Street, Polmadie, for S. Stevenson & Co., timber merchants; additions and alterations at 64, Great Eastern Road, for Dansken & Fletcher, 9, Dalmarnock Street, Parkhead. Three tenements of dwelling houses and shops in Cumbernauld Road, for Glasgow Corporation; Master of Works, City Chambers. Addition to Kinning Park Public Hall, for Glasgow Corporation; Master of Works, City Chambers. Tenements of dwelling houses and shops in Eglinton Street, for Caledonian Railway Co.; Caledonian Railway Co.'s engineer, Buchanan Street.

(Barrhead).—Four tenements of dwelling houses in Barnes Street; H. Leggatt, builder. Two tenements of dwelling houses, motor garage and workshop in Arthurlie and Heys Street, for M. Patterson.

GLASS HOUGHTON (near Castleford).—Houses, King Street, for Chas. Hattan; Red Hill Road, for Lionel Padgett; Leeds Road, for J. Thompson.

GREENOCK.—Tenement of dwelling houses in Trafalgar Street, for Wm. Strachan; tenements, with shops, at Prospecthill Street, for Wm. H. Kirkwood.

GROESFFORDD (Denbighshire).—Welsh Calvinistic Methodist Chapel.

GUILDFORD.—Proposed home for workhouse nurses. H. M. West, J.P., Chairman of the Board of Guardians.

HANLEY.—Additions to works in Old Hall Street, Johnson Bros.

HARPENDEN.—Houses, Lea Road, for G. Coburn; Wheathampstead Road, for David Knight; Willoughby Road, for A. T. H. Putterill.

HASLINGDEN.—Sewerage works at Halden Wood. Borough Engineer, Haslingden.

HASWELL (Co. Durham).—Proposed rebuilding (after fire) of premises, for Robert Clough, pawnbroker, &c.

HEAMOOR (Cornwall).—Houses, Parc Saundry, Tolcarne, Madron, for Mr. Peake.

HELENS BAY (Co. Down).—Villa. G. V. Brennan, architect, Belfast Bank Chambers, Belfast.

HERNE BAY.—Villas, Buller's Avenue, for F. Woodhouse; Fleetwood Avenue, for A. Wilson.

HIGH WYCOMBE.—Additions to house, Rectory Avenue, for Miss Rhodes; house, Rectory Avenue, for C. W. Wood; houses, Desborough Avenue, for W. R. Butler; billiard room, London Road, for H. D. Carlisle; additions to business premises, High Street, for D. Vernon & Co., ironmongers; additions to chair factory, for Cecil Smith, Newland; bakery, Ogilvy Road, for Mayhew and Sons.

HULL.—Warehouses, Garrison Side, for Saner & Harrison. John Bilson, architect, 23, Parliament Street, Hull.

(Hornsea).—Seaside home for the Hull Guild of Brave Poor Things (£1,200). Raunton & Barry, architects, Victoria Chambers, Bowlalley Lane, Hull.

ILFORD.—Additions 1 to 97 and 18 to 96, Vaughan Gardens; G. Verlyck, architect, Adelaide Chambers, Ilford. Five houses; W. W. Hitchcock, builder, 9, Colenso Road, Seven Kings. Store and four houses; E. T. Dunn, architect, 7, Roden Street, Ilford. Six shops and houses; A. W. Hudson, architect, 87, Finsbury Pavement, E.C. Unitarian church, High Road; Richardson and Gill. Motor house and store; G. Sharpe, builder, Gibbin's Road, E. Six houses; P. G. Ashton, surveyor, Station Approach, Ilford.

INCE (near Wigan).—Soap works at Platt Bridge for Hall, Benson and Parr.

LANCASTER.—Bungalow, at Silverdale, for Mr. Douthwaite; house at Hest Bank, for Dr. Muckalt.

LEEDS (Farsley).—Four houses in Priesthorpe Road, for W. Pratt.

LEIGH-ON-SEA.—New post office, Elm Road, for Dr. Watson.

LEMINGTON (Northumberland).—Elementary school at Sugley (£6,000). Northumberland C C.

LICHFIELD.—New premises, Tamworth Street, for Boots, Ltd., chemists, Nottingham.

LINCOLN.—Pavilion at the Infectious Diseases Hospital, Long Leys Road. R. A. MacBlair, City Surveyor, Corporation Offices, Silver Street, Lincoln.

LINDLEY (near Huddersfield).—New working men's club at Oakes (to be lit by electricity).

LITTLE HULTON.—Proposed railway station in Bell Lane. L. & Y. Railway Co., Hunt's Bank, Manchester.

LLANELLY.—Additions, alterations and improvements to Capel Newydd Calvinistic Methodist Chapel; O. M. Roberts & Son, architects, Portmadoc. Welsh Calvinistic Methodist Chapel, Glenalla Road; W. Griffiths, architect, Llanelly.

LLANHILLETH (Mon.).—Twenty houses for Havodarthen Building Club. D. J. Lougher, architect, Bank Chambers, Pontypool.

LLANTWIT MAJOR.—Farm buildings at Boverton Place, Llantwit Major. J. L. Lambert, architect, Bridgend.

LONDON.—Proposed new nurses' home in connection with St. Bartholomew's Hospital (£80,000).

(Finchley, N.).—Thirty-four houses and shops, G. Ball, builder, 144, Fortess Road, N.W.; five houses, Holliday & Son, builders, 74-76, High Street, North Finchley; four houses, Finchley Co-Partnership Society, Ltd.; five houses, F. E. Halford, surveyor, 8, Southampton Street, Bloomsbury, W.C.; two houses, A. W. Wheeler, surveyor, Woodside Park Station. Addition to Convent, East End Road, for Rev. Mother Superior.

LONDON (STREATHAM, S.W.).—Additions to High School for Girls, Streatham High Road. Addition to Convent of St. Andrew; E. Goldie, architect, 31, Upper Phillimore Place, Kensington.

(ST. PANCRAS, N.W.).—Buildings in Tudor Place. Peter Dollar, architect, Clock House, Arundel Street, Strand, W.C.

(MARYLEBONE).—Depôt buildings in Grove Road, N.W. J. Wilson, town clerk, Town Hall, Marylebone, W.

(UPPER CLAPTON, N.E.).—Factory in Sach Road. W. J. Fryer and Co., builders, 14, Nile Street, Hoxton.

(POPLAR, E.).—Building, Three Mill Lane; H. & G. Taylor, builders, Boyne Road, Lewisham, S.E. Store, Union Castle premises; Mark Patrick & Son, builders, 28, Westminster Bridge Road, S.W. Additions to Clarnico Works, Carpenters Road; J. G. Mathieson. Buildings on site of 1 to 5, Priory Street; Sheppard Bros., builders, Snakes Lane, Woodford. Additions to Salvation Army barracks, Kerby Street.

(SOUTHWARK, S.E.).—Additions to Guy's Hospital. Wood & Ainslie, architects, Broad Sanctuary Chambers, Westminster.

(NEW KENT ROAD, S.E.).—Four shops and houses. J. S. Lee and Sons, architects, 85, Craven Street, Charing Cross, S.W.

(SILVERTOWN, E.).—Reconstruction, for D. Dawson, of refinery building, Factory Road.

(EAST HAM, E.).—Four houses, Central Park Road. W. G. Watson, builder, 2, Milton Avenue, East Ham.

(WEST HAMPSTEAD, N.W.).—Shops and flats. Prestige & Co., builders, 149, Grosvenor Road, Pimlico, S.W.

(SOUTHFIELDS, S.W.).—Addition to Belmont; Foster & Dicksee, builders, Manresa Road, S.W. Alterations and additions to Southfield Club and Institute, Standen Road.

(STRATFORD, E.).—Addition (boiler house), Three Mills Distillery; Crickway & Son, 13, Victoria Street, S.W. Additions, The Two Puddings public house; W. Steward, architect, 4, Aldgate, E. Store at J. C. Base's premises, Marshgate Lane.

(SILVERTOWN, E.).—Addition to India-Rubber, Gutta-Percha and Telegraph Co.'s works; additions to Co-operative Wholesale Society's premises.

(GREENWICH, S.E.).—Stables, &c., for Council (£2,000). E. J. Heward, Borough Surveyor, Town Hall, Greenwich Road, S.E.

(CLAPHAM COMMON, S.W.).—Buildings. A. Wellings, surveyor, Leigham Court Road, S.W.

(BATTERSEA, S.W.).—Four houses, Wakehurst Road. W. H. George, builder, 2, Barnard Row, S.W.

(FULHAM, S.W.).—Mission hall, Wandsworth Bridge Road. Z. King and Sons, architects, 171, Victoria Street, S.W.

(DOCKHEAD, S.E.).—New factories for Spillers & Baker, biscuit manufacturers, Jacob Street, Bermondsey.

(BERMONDSEY, S.E.).—Addition to St. Paul's Church. J. M. Kennard, architect, 13, Railway Approach, London Bridge.

(TOOTING, S.W.).—Workshops. Swain & Selley, Furzedown Farm, Streatham, S.W.

(BALHAM, S.W.).—Additions to Glenbrook. W. G. Allen, Brookland, Thurleigh Road, Balham.

(CANNING TOWN, E.).—Alterations, Mansfield House, Barking Road.

(CUSTOM HOUSE, E.).—Alterations to nurses' home. E. Beasley, builder, 295, Victoria Dock Road, E.

(PUTNEY, S.W.).—Additions to St. Mary's Schools, Charlwood Road, Putney. W. R. Withams, builder, 98, High Street, Putney.

(W.C.).—Rebuilding of the Scottish Church, Crown Court.

LAUGHARNE (CARMARTHENSHIRE).—Alterations to, and renovation of, Brown's Hotel, for the Brown's Hotel Co. T. W. Millar, architect, Mountain Ash.

LYDNEY (GLOS.).—House, Primrose Hill, for Thos. Morgan.

MAIDSTONE.—Alteration to premises, King Street, for F. R. Howlett; two houses in Bower Mount Road, for Clarke & Epps; two houses in Tovil Road, for Clarke & Epps; seven houses in Hartnup Street, for J. Wright.

MANCHESTER.—New infants' school, and alterations and additions to Southall Street Municipal school, and Bank Meadow Municipal school, Ardwick, and new infants' school and alterations and additions to Ardwick Municipal school, Hyde Road, Manchester. W. H. Talbot, Town Clerk, Town Hall, Manchester.

MANSFIELD.—Houses, Church Lane and Brunt Street, for H. Holt; Debdale Lane, for F. Walker; West Hill Avenue, for E. B. Dean; King Edward Avenue, for S. F. Moss; Windmill Lane, for J. Houfton; showroom, Brunt Street, for H. Perry; proposed new school at Cresswell (£8,000).

MILLOM.—Houses, Settle Street, for Mrs. Geo. Bradley.

MILTON REGIS (KENT).—Enlargement of Upton Road Schools (£2,505). E. Bishop & Sons, builders, Albany Street, Sittingbourne.

NANTWICH.—Wesleyan schools. R. Matthews, architect, Parr's Bank Chambers, Nantwich.

NAVAN (Co. MEATH).—New National school, for the Sisters of Mercy. T. F. McNamara, architect, 50, Dawson Street, Dublin.

NEWPORT (MON.)—Technical Institute in Clarence Place, for the Education Authority; Borough Engineer, Town Hall, Newport, Mon. Reconstruction (after fire) of Newport Wesleyan Church (£1,086).

NORTHAMPTON (BRIXWORTH).—New bakery for the Brixworth Provident Co-operative Society, Ltd., Northants. C. E. Roberts & Co., bakery engineers, 62, Market Street, Manchester.

NOTTINGHAM.—Extension to the Infirmary Block of the City Asylum (£10,800). City architect, Nottingham.

OLDBURY.—Proposed school at Round's Green; A. Long, architect, West Bromwich. Proposed school at Langley; F. J. Gill, architect, Smethwick.

PINNER.—Eight houses. F. and W. Bettesworth, builders, 9, Strode Road, Willesden Green, N.W.

PORTHCAWL.—New farm buildings at Grove Farm. J. L. Lambert, architect, Bridgend.

PORTSMOUTH.—Three houses in Copnor Road; G. Lusby. Four stores in Chesterfield Road; J. Brittan, Norman Road, Southsea. Houses in Comeragh Road; W. R. Tanner, Rogart, Bramshott Road, Eastney. Houses and stables in London Road; A. Streten, 61, Stainshaw Road, Landport. Biograph theatre in Queen's Street; T. H. Lambert.

RAINHAM.—Houses, William Street, for G. Apps; Harvey Road, for H. Sayer.

RAMSGATE.—Conversion of disused public house into business premises (to be lit by electricity). Pike & Wootton, builders, Hardres Street, Ramsgate.

RAWMARSH (YORKS).—Houses, Wheatcroft Road, for Thos. Hirst.

RICHMOND-ON-THAMES.—Probable re-erection (after fire) of motor works, electrically equipped, for Smith & Co., Quadrant Road.

ROCHDALE.—Development of Hamer Hall Estate for building purposes. Important extension at Heybrook Infants' School; Rochdale Education Committee.

ROTHBURY.—Alterations and improvements to the higher grade schools and the school house.

RUFFORD (NOTTS).—New collieries to be sunk, and colony of houses; Bolsover Colliery Co.

SALFORD.—Annexe to Town Hall; Borough surveyor, Salford.

SALTBURN.—High school for girls, for the North Riding Education Committee New Primitive Methodist Church (£4,000).

SCUNTHORPE.—New fire station; Mr. Bickford, surveyor to the U.D.C.

SEAHAM.—New cookery, science, and manual instruction centre (£1,580). W. Rushworth, County Architect; T. Stephenson, jun., builder.

SHEFFIELD.—Primitive Methodist School Chapel, at Dalton Brook (£470).

SHREWSBURY.—New school at Coleham. Town Council.

SLAITHWAITE (YORKS.).—Houses, Hill Top, for Miss E. Barrett; Hill Top, for Walter Weaving.

SMETHWICK.—Houses, off Lewisham Road, for J. H. Lees; Foundry Lane, for J. F. Campbell; Rosefield Road and Watery Lane, for C. Hougham; Vicarage Road, for T. Richards & Son; Stony Lane, for F. J. Gill; shops, Cambridge Road, for Mrs. J. Haden stables, Grange Road, for T. Richards & Son; billiard room, Rawlings Road, for the Bearwood Liberal Unionist Club alterations and additions to Church, Mafeking Road, for F. W. Riley; extensions, Brook Street, for H. Pooley & Sons, Ltd. Stables for the T.C. (£1,497); T. Johnson, builder, Great Brook Street, Birmingham.

SOUTHEND-ON-SEA.—Houses, Whitefriars Crescent, for A. S. Barley Central Avenue, for J. Noakes; King's Road, for Jay & Co. Westborough Road, for C. H. Jerrard; Eastwood Road, for B. Lawford; Imperial Avenue, for Chas. Neil; Silverdale Avenue, for H. E. Nicholls; Inverness Avenue, for Joseph West; Whitefriars Crescent, for Mrs. E. Rammins; Kingsway, for J. Warren; shop, 1, Tudor Road, for A. R. Whur, builder, Princes Street; conversion of houses into shops, Leigh Road East, for Martin Ray; motor house, Chalkwell Gardens, Leigh Road West, for E. H. Fry; additions, Gray Lodge, Victoria Avenue, for W. Rudling; additions, 21, Alexandra Road, for Dr. Routh.

SOUTH SHIELDS.—Four houses, Rosebery Avenue, for W. Clunie; J. H. Morton, architect, King Street, South Shields. Extension to engineering workshops, Corstorphine Town, for the Smiths Dock Co., Ltd.; E. Box, engineer, Smiths Dock Co., Ltd. North Shields.

SPALDING (PINCHBECK WEST).—Primitive Methodist school room.

STIRLING.—Proposed restoration of West Parish Church. The Session Clerk, West Church, Stirling.

STOKE-ON-TRENT.—New Church Institute at Hanford. J. Boston, contractor, London Road, Stoke.

SUNDERLAND.—Branch library, Church Street North, for the T.C. Davidson and Cratney, architects, 22, Fawcett Street, Sunderland. Alterations to premises, High Street and Bedford Street, for Alex. Prosser, hatter and hosier; W. & T. R. Milburn, architects, Sunderland.

SURBITON.—Sewage disposal works for the U.D.C. (£39,991). Johnson & Co., contractors, Hereford.

SWANAGE.—Proposed hospital for consumptives. Swanage U.D.C.

SWINDON.—Eleven houses, Kent Road. A. J. Colborne, builder.

SWINTON AND PENDLEBURY.—Houses, Charles Street, for H. Way; St. Peter's Road, Swinton, for Evan Ellis.

THORNTON (near PRESTON).—Additions to house, Whiteside Way, for Councillor Ashton.

TIPTON.—Restoration of St. Mark's Church, Ocker Hill. Mr. Beck, architect, Wolverhampton.

TREDEGAR.—Armageddon Baptist Church to be rebuilt by the Tredegar Iron and Coal Co.

TROEDYRHIW (GLAM.).—Bakery, &c., for the Co-operative Society. John Evans, secretary.

TUNSTALL (STAFFS.).—Rebuilding, after fire, of Alexandra Pottery. Johnson Bros., Ltd.

ULVERSTON.—Parish Hall at Allithwaite, for J. Bliss, J.P.

UPPINGHAM.—Houses, Forty Lane, off Stockerston Road, for J. H. Sargeant.

UTTOXETER.—Primitive Methodist Church at Dodsleigh. W. Campbell, architect, 2, Bagnall Street, Hanley; Ward & Godbehere, builders, Uttoxeter.

VENTNOR (ISLE OF WIGHT).—House, Steephill Cove, for Isaac Wesley. T. R. Saunders, architect, Belgrave Road, Ventnor.

WALKDEN.—Four houses in Harriett Street. J. W. Cooke, Bolton Road, Walkden.

WALTON-ON-THE-HILL (SURREY).—House, The Heath, for A. Paull, Lower Kingswood; additions to house, for Dr. Richards.

WARRINGTON.—Tannery extensions for Guest Bros.

WALLINGTON (SURREY).—Shop, Morgan Baines & Clerk, surveyors, Railway Approach, Sutton. Iron school; Trustees, Wesleyan Methodist Church.

WATFORD.—Additions to Silverdale Laundry; W. Judge, builder, 153, High Street, Watford. Petrol store, Cassiobury Mills, St. Alban's Road. Twenty houses, Vicarage Road; W. Judge, builder, 153, High Street, Watford. Two villas; Clark Bros., builders, Fearnley Street, Watford. Offices, Woodford Road, for L. & N.W. Railway Co., Euston. Additions to workhouse (vagrant wards); Clerk to the Guardians. Two shops and houses and new bakehouse; J. Rodwell, builder, New Bushey. New vicarage, Mildred Avenue, for Rev. W. H. Littlebury. Proposed Central Primitive Methodist Chapel.

WELLINGBOROUGH.—Alterations and additions to Bushfield Waterworks, including new filtering and softening plant, for the U.D.C.; E. Y. Harrison, surveyor to the U.D.C., Park Road, Wellingborough. Proposed free library, at Irchester; Sharman & Archer, architects.

WHITSTABLE.—Proposed extension of the Baptist Sunday School (£500).

WINDSOR.—Rebuilding Carpenter's Arms, for Ashby's, Ltd.; motor premises, St. Leonard's Road, for E. Dowsett.

WOLVERHAMPTON.—Electrical installation at St. Chad's Church; new jam works to be electrically equipped, for Reade Bros.

WOOTTON (ISLE OF WIGHT).—New church; Percy G. Stone, architect, 33a, Holyrood Street, Newport, I.W.

WORSBOROUGH (near BARNSLEY).—Houses, Mount Vernon Road, for Geo. Cooke; The Walk, Birdwell, for Mr. Quilter; Peel Street, Worsboro' Common, for Geo. Allen.

WORSLEY.—Additional block of houses on Worsley Green; Lord Ellesmere.

YEOVIL.—House and shop, Sherborne Road, for Canon Cole; house, Alexandra Road, for T. H. Foan.

YTHAN-WELLS.—Alterations to school; W. L. Duncan, architect, Turriff.

Synthetic Rubber.—The *Daily Mail* reports that Dr. Docherty and Mr. Alsebrook, of Burton-on-Trent, claim to have discovered a chemical process for making on a sound commercial scale rubber which is equal to the best Para rubber. In the distillation of rubber a hydrocarbon, isoprene, is given off, which rapidly undergoes change into the gelatine group. It was found that by preventing isoprene from undergoing this change it formed a latex which could be coagulated into rubber.

MUNICIPAL TRAMWAYS ASSOCIATION.

On Wednesday, in dull and heavy weather, which, however, speedily gave way to sunshine and warmth, the seventh annual conference of the Municipal Tramways Association was opened in the Exchange Hall, Nottingham, a reception by the Deputy-Mayor (in the absence of the Mayor), Sheriff, and chairman and members of the Nottingham Tramways Committee preceding the Conference, which commenced at 10.30.

After a few words of cordial welcome from the Deputy-Mayor, from Alderman Brownsword on behalf of the Tramways Committee, and from Mr. Sheriff Carey, Mr. Aldworth (general manager of the Nottingham Corporation Tramways) read his presidential address, which was followed by a paper on "Some Through-Running Problems and their Solutions," by Mr. H. E. Blain, general manager of the West Ham Corporation Tramways. The paper was discussed at some length, without arriving at conclusions of material value. The conditions prevailing in London and in provincial towns are so utterly different that the provincial tramway managers are unable to appreciate the conditions obtaining in the Metropolis, and *vice versa*. The paper was regarded as a valuable one for future reference, though it contained several errors which were pointed out. The general opinion of the speakers, so far as the suburbs of London are concerned, was to the effect that, if some special means cannot be found to combat the competition of the motor-'bus, there will soon be nothing left but L.C.C. cars and "Vanguards."

At one o'clock an adjournment was made, at the invitation of the Nottingham Corporation Tramways Committee, to the Victoria Station Hotel, where luncheon was served.

In the afternoon there followed an inspection of the Trent Bridge Car repairing works and the St. Ann's Well Road generating station.

Special provision was also made for the ladies of the party, who were conveyed by steamer from Trent Bridge to Colwick Weir, afternoon tea being served at Colwick Hall, and the evening was devoted to a reception by the Mayor, the Chairman, and the Vice-Chairman of the Nottingham Tramways Committee at the Art Museum, Nottingham Castle.

The programme for Thursday provided for papers on "Treatment of Corporation Employés Incapable of Performing Ordinary Duty," by Mr. Alderman H. Linsley (chairman, Salford Corporation Tramways Committee); and "The Application of Technical Science to the Construction, Maintenance and Operation of Tramways," by Messrs. R. G. Cuncliffe and J. G. Cuncliffe (assistant electrical engineers, Manchester Corporation tramways), in the morning, and one on "Ticket Check," by Mr. L. Mackinnon (traffic superintendent, Glasgow Corporation tramways), in the afternoon. The Association dinner at Victoria Station Hotel was to take place in the evening, and during the day the ladies proceeded to Sherwood Street factory to inspect the manufacture of fancy lace, by kind invitation of Mr. John Cutts.

We give below an abstract of Mr. Aldworth's address :—

The President remarked that there could be no question that the Association had fully realised the purposes for which it was established and had rendered valuable assistance to all connected therewith. He suggested that the time had arrived when the status of the Association should be raised, and that the Executive Committee be instructed to take the necessary steps to secure its incorporation.

The membership included over 120 chairmen and vice-chairmen of committees, representing practically all the local authorities operating their own tramways, with about 100 general managers and chief officials. Local authorities had invested in these undertakings, roughly, 40 million pounds. They operated 2,500 miles of track with 8,000 cars and 40,000 employés, which served a population of 17½ millions. Their joint revenue last year amounted to 8¾ million pounds, the number of passengers carried was 1,886 millions, and the cars ran 195 million miles.

The meeting of the Managers' Section was this year held at Wolverhampton; important papers were read on "Car Building in Departmental Workshops" and "Tramway Rating Valuations and Income-Tax Assessments." Tabulated information respecting the distance at which a tramway passenger paying a 1d. fare ceases to be remunerative was also laid before the meeting.

Unquestionably the most important matter under the consideration of the tramway industry was that of brakes and safety appliances for cars. This had been emphasised by the distressing accidents which had taken place during the year. A large number of meetings of the Brakes Committee of the Association had been held, many undertakings visited, and a considerable number of brakes of various designs inspected and tested in operation. Exhaustive experiments and tests had also been carried out, and it was hoped that the results would indicate means by which the risk of accidents arising through cars getting out of control might be greatly minimised, if not entirely removed.

The important question of what allowance should be made for depreciation of assets by the Board of Inland Revenue, when dealing with the profits for income-tax purposes, had been receiving very careful attention, and appreciable progress had been made towards arriving at a settlement of this very complex subject.

Other matters, including proposed new regulations by the Board of Trade; the use of tramway poles for telegraph and telephone purposes; corrugation of rails; the maintenance of street paving along tramway routes; the report of the Departmental Committee on Accounts of Local Authorities, and Mutual Assurance against Third Party Risks, had also been under consideration by the Executive Committee.

Speaking generally, the year had been a time of "peace and goodwill" as regarded the relations existing between committees and their employés. It should be remembered that their duty to the staff did not cease with the payment of their wages; courtesy and friendly respect were also due to them.

It was to be regretted that efforts had been made, in a few cases successfully, to transfer the decisions on matters of discipline from the manager to the committee—in other words, from an impartial to an interested tribunal—a departure from the policy which had in the past worked very satisfactorily. This meant practically the transference of responsibillty for the safe and efficient working of the undertaking from the manager to the committee—a serious departure indeed, as responsibility without control was impossible in any real sense.

It was essential that the public should be given the best possible service, and carried at the lowest fares justified by the returns, but not lower than would permit of the undertaking being conducted on sound commercial principles. It was a satisfactory sign of the times that much less was being heard of the demand for half-penny fares and stages, and many other concessions of a hazardous nature, which at one time were so vigorously pushed, irrespective of local conditions.

As Mr. John Young said in his presidential address at Glasgow in 1902, municipal tramways differed as properties in so many respects that the same practice could not apply to all; but there was one common essential to the success of such commercial undertakings, and that was that they must be efficiently conducted, and managed on pure business principles.

All tramway systems, whether large or small, municipal or company-owned, were a great convenience to the residents in the districts through which they ran; therefore the owners, be they ratepayers or shareholders, were entitled to their share of the benefits, and those using the cars should be willing to pay such fares as would give a reasonable return upon the capital invested.

On the question of intercommunication evidently a much broader view was being taken, as was shown by the continual increase in the number of municipalities which had entered into working agreements for this purpose with other undertakings, both municipal and company-owned. There could be no question that such arrangements gave facilities which greatly encouraged the use of the cars, and increased the usefulness and earning capacity of the undertakings concerned.

A matter deserving of serious consideration was the adoption of an improved method of collecting and checking fares. The "Pay-as-you-enter car" which was being introduced into Canada and the United States, appeared to be marking progress in this direction. It remained for some inventive genius to devise an equally effective method applicable to the general conditions prevailing in this country.

They were all familiar with the irritating sound of cars running over defective rail joints and worn points and crossings, and appreciated the great damage to the rolling stock and rail bonding, as well as the discomfort caused to passengers and residents along the route. Recent improvements would go a long way to obviate this with new tracks; but the difficulty was to overcome the trouble on lines which had been in use for some years. In Nottingham the matter had received very careful attention, and as a result of experiments, extending over several years, it had been decided to repair defective joints by cutting away the worn portion of the tread and inserting a flat plate of special steel, which bridged the rail joint and rested on both rails. The ends were splayed and dovetailed into the rails. During the three years since the first joint was so treated not a single plate had worked loose, notwithstanding that there had been a two-and-a-half minutes' service running over the route.

The petrol motor-'bus, which a few years ago they were told was going to revolutionise street passenger traffic and practically exterminate tramways, had had a fair and impartial trial, and the verdict was certainly not in its favour. The electrobus was free from many objectionable features inseparable from the petrol vehicle; but whether accumulators could be found to withstand the vibration and strain to which they were subjected, especially on rough and hilly roads, and enable the 'bus to be worked at such a cost as would allow it to give a fair return on the outlay, remained to be seen. There was unquestionably a large field available for the successful working of a service of self-contained, reliable, and economically-operated vehicles.

A subject which was becoming more and more urgent was the drafting and adoption of model by-laws and regulations which would assist their undertakings to adequately meet the exacting calls now being made upon them. Those formulated for meeting the conditions prevailing in the horse-car days answered their purpose very well, but they were certainly not adapted to the present-day requirements of working.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

WE are asked to publish the following orders:—

Head Quarters: REGENCY STREET, WESTMINSTER, S.W.

The Head Quarters will open for the winter's training on October 5th, 1908.
Medical Inspection for Recruits every Tuesday, commencing on the 29th inst.
Intending Recruits should reach Head Quarters as soon after 6 p.m. as possible.

(Signed) J. H. S. PHILLIPS,
Capt. and Acting Adjutant.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Lisbon Electric Tramways, Ltd. (62,983).—A statement of the total amount outstanding on July 1st in respect of mortgages and charges created prior to that date and not required to be registered under Sec. 14 of the Companies' Act, 1900, has been filed pursuant to Sec. 13 of the Companies' Act, 1907. Particulars: Mortgage dated November 22nd, 1899, securing £345,000.

Peterborough Electric Traction Co., Ltd. (74,562).—This company's annual return, made up to May 12th, was filed July 17th. 8,400 shares have been taken up out of a nominal capital of £60,000 in 6,000 ordinary and 6,000 preference shares of £5 each. £5 per share has been called up on 4,000 ordinary and 4,400 preference, resulting in the receipt of £42,000. Mortgages and charges: £21,000.

NOTES.

Points Not Generally Known.—That the Loch Leven Water Power Co. has procured or is obtaining nine hydraulic turbines, of a total of 30,500 H.P., from the Swiss firm of Escher, Wyss & Co.

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That the Zoelly steam turbine has entered into strong competition with the Parsons turbine, and is being introduced in a German cruiser of 20,000 H.P. and in torpedo boats.

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That the Parsons steam turbines adopted for some of the other German warships have been made in Switzerland—by Brown, Boveri & Co.

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That the competition in steam turbines has become so acute on the Continent, that apprehensions are entertained that the business, as in the case of high-speed vertical engines in Great Britain, will soon become unprofitable.

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That, notwithstanding the protection of the Customs tariff in France, electrical manufacturers do not find prices so advantageous as in former years.

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That, owing to the operation of price protection and firm protection agreements in Germany, real competition has now practically been extinguished, even for contracts thrown open to the value of as low as £500.

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That trade in Russia is improving, and is very largely controlled by branches of Teutonic firms.

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That the financial results of the suspended electric railway between Elberfeld, Barmen and Vohwinkel have just been published, probably for the first time.

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That they show a surplus of £28,000 for 1907, but that it is not stated whether the surplus implies actual net profits of that amount.

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That Belgian electrical firms are doing, for a comparatively small industrial country, a large business in the electrical equipment of rolling mills and collieries.

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That the proposed tax on the consumption of electricity in Germany would unfavourably affect the light electric railways and tramways, as the average yield, without making provision for reserve fund, is said to amount only to 2½ per cent.

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That the new French cable factory, forming one department of the Ateliers de Construction du Nord et de l'Est, at Jeumont, had orders on hand of the value of £168,000 at the beginning of April.

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That the Russian laws do not recognise strikes as *force majeure*, and German firms are consequently being mulcted in penalties for delays in the delivery of apparatus for the St. Petersburg telephone exchange.

Appointments Vacant.—Shift engineer, Leicester Corporation tramways power station; switchboard attendant for Kendal (25s.). See "Official Notices" to-day.

Storage Battery Railway Coaches in Germany.—It is tolerably well known that experiments with storage battery coaches have been in progress for several years past on certain railways in Germany, for the purpose of dealing with local and other short-distance traffic. The Palatinate railways represent one instance of this kind, and the district of Mayence forms another. The coaches used on the latter lines are now stated to have well answered the purpose, although this does not imply that those worked on the former railways have not been equally satisfactory from an operating point of view. What the financial results have been is perhaps only known to the managements of the railways concerned, but where storage battery coaches have supplanted steam trains, it is possible to conceive that they may have effected an economy over the cost of steam locomotion for this particular kind of short-distance traffic. Yet in this event the saving would not of necessity indicate that the battery coaches are yielding net profits, as the local steam trains may formerly have been worked at a loss, and the battery coaches may merely have been the means of reducing the amount of the loss. At any rate, the passenger traffic has been sufficiently well handled by the electric coaches, as in the case of the steam motor coaches which have been introduced on several English railways for local services, to induce the Prussian State Railway authorities to make a trial on the same system on what may be said to represent a fairly large scale.

The Prussian Railway authorities, in fact, ordered 57 battery coaches nearly a year ago from the Allgemeine Electricity Co., the Siemens-Schuckert Works Co., and the Felten and Guilleaume-Lahmeyer Works Co. The coaches are intended for use on a variety of lines, and the large number indicates the determination to give the system an exhaustive trial. The idea underlying the adoption of battery coaches is for dealing with the suburban traffic of medium sized towns, to act as feeders for stations where fast through trains are accustomed to stop, to increase the traffic on busy sections, and to serve as substitutes for steam trains in localities having but little traffic. The delivery of the rolling stock is expected to take place shortly, and the first double coach built by the Allgemeine Co. was recently tested on the railways at Dresden and Berlin.

The coach consists of two closely coupled carriages, each of which is carried on two axles and has a battery arranged in a separate compartment at the front, thus protecting the passengers from the danger of acid fumes. Accommodation is provided in the double coach for 100 passengers in two classes, and each coach has a driver's platform at each end, which serves for the entrance of passengers, as in the case of tramcars, the gangway being down the centre. The battery equipment comprises 168 cells, giving a pressure of 310 volts, and one charge is capable of enabling the two motors, of 80 H.P. each, to propel the double coach a distance of 62 miles, the maximum speed being 31 miles an hour.

It is proposed to work the double coach with a single driver and without any other train attendant, on lines which may be suitable for the purpose. In order to protect the passengers from injury in the case of the driver becoming ill or meeting with an accident, an emergency brake has been provided which will come automatically into operation in the event of the driver losing hold of the controller handle, whilst at the same time the passenger compartments are also equipped with emergency apparatus for the application of the air brakes. The coach body has been built by the Breslau Railway Carriage Construction Co., the batteries by the Berlin-Hagen Accumulator Co., and the electrical equipment by the Allgemeine Co. The type of coach is stated to have been suggested by Herr Wittfeld, of the Prussian Ministry of Public Works, and the trials made at Dresden and between Berlin and Zossen are reported to have been entirely satisfactory.

A Kelvin Memorial.—The *Standard* reports that Mr. A. Bruce-Joy has been selected by the committee for the memorial to the late Lord Kelvin to execute the statue to be erected in Belfast.

Electric Shock Fatalities.—On Friday, Charles Buxton, a foreman painter in the employ of the Butterley Ironworks Co., Ripley, Derby, was engaged with Frank Anderton in painting the plain standard and girders which carry the overhead wires on the new single-phase line of the Midland Railway between the Lancaster Green Ayre (Midland) Station and the Castle (L. & N.W. Railway) Station. They received a signal that a goods train was leaving the station, and Anderton got off the girder. Buxton said he would go down for some paint, and in doing so he missed his footing. In trying to save himself he threw his right arm over a "live" wire, and, receiving a shock at 6,500 volts, was instantly killed. His body immediately caught fire. Anderton raised the alarm, and the current was switched off. The deceased's right arm dropped on to the line, and the right side of the body was also shockingly burned. Deceased had asked for a flagman to warn him of approaching trains, so was apparently aware of the dangerous nature of his occupation.

At the inquest on Saturday, evidence was given by Anderton that when they received the signal Buxton said, "I'll get out of the way." He was 3 ft. from the live wire at the time he fell.

Thomas Storyaker, 12, Argyle Street, Lancaster, the flagman on the job, said he received no signal of the approach of the train, but was working on a time table. The train was due at 10.33, and he gave the men notice at 10.24 a.m. When coming down for paint Buxton put his hand on the insulator. A blue light flew out, and he fell with one leg over the top of the girder and the other through it. His hand was still on the insulator and he fell backwards with his shoulder touching the live wire underneath. The line was disconnected in three minutes, but death had taken place.

Edward Lightfoot, signalman, in the employ of the London and N.W.R. Co., said he did not know the men were working there.

D. S. Johnson said the body was locked between the girders. The right arm had dropped off, and the body was badly burnt on the side nearest the electric wire.

Herbert Walter Spendlow, electrician in charge of the single-phase equipment, said that only persons with permits from himself were expected to work about the electrical equipment. Nobody knew the deceased was working there—he was not in their department. The voltage on the line at the time of the accident was 6,600. The girders were 19 in. wide. With such a voltage, if the deceased put his hand on the insulator within ¾-in. of the wire, the current would go through his body. One-tenth of an ampere might be fatal, but he would get three amperes through his body. There was no reason, electrically, why the signals should not be worked independently of the switching on of the current, and so long as there was steam and electric traction on the same line, it was desirable for safe working that some such arrangement should be adopted.

Charles M'Lean, Derby, who designed the overhead electrical equipment, said there was 10 ft. on one side of the wire, and 4 ft. on the other, where it was perfectly safe. If the insulator was out of order the whole girder would be alive. The Butterley Co. did not advise them about coming on to this particular job, or arrangements would have been made to protect their men.

The Coroner said that at first it appeared as if there had been some neglect in making arrangements, but if anybody was to blame, it was the deceased himself.

The jury returned a verdict of "Accidental Death," attaching no blame to anyone.

According to a Leeds paper Vincent Southam, aged 26, of High Green, was killed on the night of 15th inst. at the Knoll Drift Pit, belonging to the Wharncliffe Silkstone Colliery Co. A fall of roof brought down two live electric wires used in driving coal-cutting machinery. These caught Southam, who died shortly afterwards from shock.

On 17th inst. an inquest was held in connection with the above. According to the evidence deceased was, with others, fetching some empty corves, and found some full corves in the road. They removed these, when they found an electric cable had fallen, owing to a fall of roof. The deceased was subsequently found lying across the rails, he having had a shock through having hold of the corve. He was standing in water at the time and received a shock at 550 volts. Mr. Jonathan Wroe, manager for the Wharncliffe Silkstone Colliery Co., promised that further precautions would be taken. The jury returned a verdict of "Killed by receiving an electric shock by a displaced cable."

The other day at the works of Kirkpatrick Bros., Ballyclare, Co. Antrim, whilst the electrician, Adam Nicholl, was working near the machinery he was caught by it and whirled round at a terrific rate, receiving such ghastly injuries that he died within half an hour.

Copper.—Messrs. Merton's mid-monthly circular shows the market still nearer to the figure for visible supplies anticipated in this column a month ago. The figure is now 48,430 tons. In the face of this astonishing quantity buyers will need to proceed carefully, as it is fairly evident that the continuance of such stocks must result in lowering the price, which will instantly thereafter soar on large orders being given out. At present we have in English ports 32,096 tons of standard copper, and 2,017 tons of fine copper. Previous to June last 31,158 tons was considerably the highest figure for the whole visible supplies for the past three years. Incoming supplies, however, show rather a narrowing tendency, which is rather to be expected. A slight rise in price would probably restore these to the normal.

Radio-Dermatitis.—We regret to learn from recent reports that Dr. Hall-Edwards still suffers from extreme tenderness in the arm that was first operated on, which has prevented the attachment thereto of any mechanical appliance. An appeal has been made for further subscriptions, to provide him with adequate comforts and attendance, and has already borne good fruit.

Institution and Lecture Notes.—Liverpool and District Electrical Association.—On Tuesday, September 15th, an interesting illustrated lantern lecture was delivered before this Association at the Common Hall, Hackins Hey, Dale Street, by Mr. C. H. Verity, of Seacombe, entitled "Steam Turbines." The chair was taken by Mr. B. L. Myer, of Liverpool. Mr. Verity, in the course of his lecture, dealt very fully with turbine construction, especially with regard to the fixing of the blades, and his remarks were very ably assisted by the many excellent lantern slides which were shown. Figures were also exhibited showing strongly in favour of steam turbines for marine work.

A party of members of the above Association paid a visit on Saturday afternoon, September 19th, to the works of the Railway Signal Co., Ltd., Fazakerley, near Liverpool. On arrival at Fazakerley railway station, the party were met by Mr. Vickers, who personally conducted the visitors over the premises. An inspection was made of the erecting shop, drop stamping department, die cutting department, smithy, iron and brass foundry, pattern shop, iron signal shed, joiners' shop and sawmill, staff instrument department, and the electrical shop. The next meeting will be held on Tuesday, September 29th, at 8 p.m. There will be an open meeting and discussion on the visit to the Railway Signal Co., Fazakerley.

Institution of Municipal Engineers.—The membership roll now stands at 320. Draft by-laws have been approved by the executive committee, subject to confirmation at the general meeting of members to be held on Friday, October 9th, and it has been decided that, recognising the great possibilities of an Institution of Municipal Engineers in the widest sense of the term, men holding important appointments under local authorities as electrical, gas, mechanical, and water engineers shall be eligible for election to membership of the Institution. Particulars may be obtained of Mr. B. Wyand, secretary, 10, Eagle Place, Piccadilly, London, W.

Educational Notes.—East London College.—We are informed that the Drapers' Company has voted special grants for the purchase of important additions to the equipment of the Engineering Department, the staff and students of which have carried out a series of tests of vanadium steel, and other special steels, which are being largely used in the construction of high-speed engines. The recent installation in the Electrical Engineering Department of an 11-kw. rotary converter of special design should be of great use to senior students and to those seeking to carry out standardisation experiments. The calendar for 1908 9 shows that the new session begins on the 28th inst. Prof. J. T. Morris is the head of the Electrical Engineering Department, assisted by Mr. L. Murphy.

Portsmouth Municipal College.—A very fine municipal college has just been opened in the borough. One of the departments which deals with civil, mechanical and electrical engineering, is provided with laborstories for electrical testing, two dynamo rooms, a repair shop and a battery room. Continuous current from the generators and from the battery, and alternating current of one, two or three phases is supplied to each table. Among the machines that have been installed are a 15-kw. motor-generator, 5-kw. dynamo for battery charging, 5-b.h.p. series motor, a 30-kw. set which will take the normal power load, a quadruple set (each machine of about 5 h.p.), a balancing set, and a small three-phase induction motor. There are between 20 and 30 motors of various types scattered through the building.

London Private Fire Brigades.—The London Private Fire Brigades Association, which now comprises 850 members, held its fourth annual competition at the Guildhall on Saturday, 19th inst. The Challenge Shield which is presented by the Corporation of London for the encouragement of good work among the private fire brigades of London is of solid silver, and is worth considerably over £100. Teams representing 15 brigades competed, and the competition was divided into two parts, the first taking place outside the Guildhall with one officer and four men, hydrant (wet) drill, and the second part in the hall itself, this being a surprise drill (dry) for one officer and six men. The nature of the latter drill was such as to bring out the good points in brigades when dealing with sudden outbreaks of fire, and it was in no sense a set show drill which a team could win by practising. At the conclusion of the competition, Mr. John H. Lile, chairman of the City Lands Committee, announced that the challenge shield had been won by the Robertson Electric Lamp Co.'s Brigade, and the three first times were as follows:—

1. Robertson Electric Lamps, Ltd., Brook Green ... 360⅖ sec.
2. Bradbury, Wilkinson & Co., Ltd., Farringdon Road 403⅗ "
3. R. H. & S. Rogers, Cliftonville Works, Rotherhithe ... 410⅖ "

The competition was watched by the Lord Mayor and Sheriffs, accompanied by members of the City Corporation, Col. Fox (chief of the Salvage Corps), Lieut. Sladen (third officer of the Metropolitan Fire Brigade), &c. The Lord Mayor, in presenting the shield and silver medals to the winning team, congratulated them on their activity and energy and upon the fact that they were the first team to win the shield for the second time.

Aberdeen's Limit.—According to a Scottish correspondent, an effort is being made by the Aberdeen authorities to put down spitting in the tramway cars in the town. It appears that an official maximum of "three spits" is allowed, but in the case of six persons this limit has recently been exceeded. All six were nominally fined at the local Justice of Peace Court.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Electricity and Street Lighting Committee of Bermondsey received 126 applications for the post of engineer-in-charge to fill the vacancy caused by the promotion of Mr. Hogarth, at a salary of £110 per annum without pension. Mr. Cragg, of Putney, has been appointed to the position.

Mr. J. Milton has resigned his appointment as shift engineer at the Battersea B.C. electricity works to take up an appointment as chief assistant engineer to the Wycombe (Borough) Electric Light and Power Co., Ltd. The Battersea Lighting Committee has resolved that Mr. W. H. Healy, at present engaged as draughtsman at the central station, be appointed shift engineer on probation for three months, at a salary of £120 per annum, and that the electrical engineer be authorised to engage a person temporarily to take the place of Mr. Healy.

The Handsworth District Council has resolved to increase the salary of its electrical engineer, Mr. Nixon, from £350 to £400.

Last week Mr. R. F. Ferguson, Corporation electrical engineer at Hastings, acting on behalf of the staff and employés of his department, presented Mr. C. E. Coleman, third employé at the works, with a slide rule in leather case, on his departure to take up a position under the L.C.C.

Mr. L. O. Cox, mains engineer, was presented with a revolving bookcase and cake stand by the staff and employés of the Leyton Urban District Council's electricity works, on the occasion of his marriage. The presentation was made by the engineer and manager, Mr. F. Harman-Lewis, on Friday, September 18th, in the presence of the staff and workmen.

Tramway Officials.—On Thursday last week Mr. Eardley, manager of the Stockport Corporation Tramways, on behalf of the tramway employés, presented a gold medallion to Sergeant Knighton, of the fire station, for his services in rendering "first aid" and saving the life of John Roscoe, a tramway conductor.

General.—Mr. W. A. Barnes, A.M.I.E.E., has been appointed instructor in electrical engineering for the winter session at the Technical Institute, Horwich, Lancashire.

The Home Secretary has appointed Mr. Robert Nelson, of the firm of Messrs. Merz & McLellan, to the newly-created post of H.M. Electrical Inspector of Mines.

On 12th inst. the marriage of Mr. Gomer B. Davies, A.M.I.E.E., of the York Street Flax Spinning Mills, Muchamore, and late of the Stepney and Guildford electricity supply works, to Miss Helen Elizabeth Supple, took place at All Saints', Antrim, Ireland.

Dr. C. C. Garrard has resigned the position of manager of the instrument and transformer department of Messrs. Ferranti, Ltd., in order to take up that of manager of the switch department of the General Electric Co., Ltd.

Mr. Fred. R. Hodges, late managing director of the Electrical and Maintenance Co., of Sunderland and Newcastle, has taken up an appointment with Messrs. Warren, Hawkins & Co., of Milburn House, Newcastle-on-Tyne, as outside traveller and manager for their contracts and supplies.

In reference to our recent article on Rose's Patent Electrical Recording Target (that electrical device for instantaneously recording at the firing point the exact position of each and every shot fired), it may be of interest to note that Mr. T. C. Baddeley departs this month to take over the management of Mr. Sydney A. M. Rose's electrical factory in Melbourne, with a view to further developments. Mr. Baddeley has spent several months with Mr. Rose, acquainting himself with all the necessary manufacturing details, and has visited most of the leading English and French factories, in order to be thoroughly *au fait* with the latest points and appliances for labour saving in electrical manufacturing concerns.

Obituary.—J. C. Nicholson.—The death occurred on 19th inst. at Newcastle-on-Tyne of Mr. Joseph Cook Nicholson, principal of the Joseph C. Nicholson Tool Co., of Collingwood Street, Newcastle-on-Tyne. Mr. Nicholson, who was a well-known figure in the tool manufacturing industry of the North of England, was a native of Sunderland, and was born in 1859. As a youth he was engaged at several Durham collieries, but studied engineering and science, and when his father died in 1881 he took charge of the latter's business at Sunderland—a file manufactory. Four years later he commenced the manufacture of engineers' tools at Sunderland, and in 1892 transferred the business to Newcastle. The deceased gentleman was a member of the North of England Institute of Mining and Mechanical Engineers, Federated Institute of Mining Engineers, and of the North-East Coast Institution of Engineers and Shipbuilders.

CITY NOTES.

Dick, Kerr & Co., Ltd.

The directors' report to June 30th, 1908, has been issued, together with the profit and loss account of the company's trading for the 12 months ended that date. The profits earned amount to £59,558. Out of this has had to be paid debenture interest and trustees' fees, and there has been reserved the sum required to provide for the premium payable on the redemption of the present debenture stock. These items absorb £12,832, leaving a balance of £46,727, to which must be added the profits brought forward from last year, viz., £79,140, making a total of £125,867 available for appropriation as under:—Dividend of 6 per cent. per annum on preference share capital, £18,300 (the proportion of this dividend to December 31st, 1907, has already been paid); dividend of 10 per cent. on ordinary share capital of £260,000, to be paid, less income-tax, £26,000; balance to be carried forward, £81,567; total, £125,867. The dividend on the preference shares will be paid on October 1st, 1908, as usual, and the dividend recommended on the ordinary shares will be paid when approved by the shareholders. In view of the continued severe competition in all departments, the directors consider the result of the year's trading not altogether unsatisfactory.

Last year the profits were £80,476, and the dividend on the ordinary shares was at the same rate.

United Electric Car Co., Ltd.

Mr. R. H. Prestwich presided at the annual meeting held at Preston on September 17th. In moving the adoption of the report (see Electrical Review, September 11th, page 429), he said that no doubt the result for the past year would be disappointing in view of the profit made for the year ending June 30th, 1907, and it was with much regret that they were unable to recommend a dividend on the ordinary shares. Those who were present at the last meeting, however, would remember that the chairman foreshadowed a falling-off in the profits. As he stated, there was then a stagnation in electric traction which was affecting all car-builders, as well as electric equipment manufacturers. Instead of matters improving, however, they had grown worse, with the result that the company's output last year was less than one-half of what it was for the preceding year. In view of this very greatly decreased output, without a corresponding decrease in expenses, the directors considered it satisfactory that a profit had been earned. There had been a saving in expenses all round, compared with last year, while instead of a debit for interest, bank rate, and commission of £1,778, there was a credit of £220, so that the result of having a substantial balance in the bank had meant a saving of roughly £2,000. The amount carried forward was £6,187, or £1,092 more than last year. As regarded the company's financial position, the balance-sheet showed a very healthy state of affairs. On June 30th there was upwards of £34,000 in the bank, while the whole liability to creditors was only £16,841, which was less than half for the corresponding period last year. With regard to the reserve for depreciation, amounting to £30,000, the directors thought it a wise policy to increase it whenever possible, though it might not always be necessary to add to it to the extent of £4,000 or £5,000 a year as hitherto. He regretted that there were no signs of an immediate improvement in the prospects for the coming year. Trade generally was in a very depressed state, but he hoped that, as soon as it took a turn, the Car Co. would benefit.

A Shareholder, referring to the item of £600 for directors' fees, seemed to think that this should have been omitted. Another speaker inquired if the directors had any information as to the Hadley and Trafford works being disposed of, or whether they were likely to be sold.

The Chairman said they were trying to dispose of them, but it was a very difficult matter. There was a possible chance under the influence of the new Patent Laws of being able to do so to foreigners, but the directors saw no chance of making use of them themselves, and were trying their best to dispose of them. He pointed out that with regard to the Trafford works there were no expenses beyond the chief rents, and that the Hadley works were very well let.

A Director remarked that the rolling-stock trade was very bad indeed at present, and the Chairman observed that the directors were not entirely without hope with regard to business. If they looked far enough ahead he thought they could see business coming forward, but he had no desire to promise anything.

After further speeches the report was adopted.

Anglo-Argentine Tramways Co., Ltd.—At meetings of the various classes of shareholders and debenture-holders, held last week in the City, resolutions were passed raising new debentures to enable them to pay off the £200,000 5 per cent., and the £80,000 5½ per cent. debentures of the Buenos Ayres Electric Tramways Co. The Anglo-Argentine Co. now holds the entire share capital of the latter company, which it will wind up as soon as possible, merging it into its own undertaking. The directors have in contemplation the acquisition of every tramway concern in Buenos Ayres with one exception.

Stock Exchange Notices. — Applications have been made to the Committee to allow the following securities to be quoted in the Official List: — Havana Electric Railway Co.—$1,115,000 additional Consolidated Mortgage 5 per cent. 50-year Coupon bonds, 1952, for $1,000 each, Nos. 6,958 to 8,072. Mexico Tramways Co.—$400,000 additional General Consolidated First Mortgage 50-year 5 per cent. Gold bonds.

Direct Spanish Telegraph Co., Ltd.—The board have decided to pay in addition to the dividend at the rate of 10 per cent. per annum on the preference shares, an interim dividend at the rate of 4 per cent. per annum, free of income-tax, on the ordinary shares, both for the half-year ended June 30th, 1908, and payable on October 1st.

Folkestone Electricity Supply Co., Ltd.—The directors announce an interim dividend of 4 per cent. per annum (2s. per share), less income-tax, on the ordinary shares for the half-year.

Sir W. G. Armstrong, Whitworth, & Co.—An interim dividend of 10 per cent. per annum on the ordinary shares has been declared.

New York Central and Hudson River Railroad.—A dividend of 1½ per cent., payable on October 15th, has been declared.

Melbourne Tramway and Omnibus Co.—A dividend of 4½d. per share (15 per cent. per annum) is payable on October 1st.

Belgium.—The balance-sheet of La Compagnie Electrique Anversoise, of Antwerp, for the last financial year shows a profit of £43,458, as compared with £43,839 in the preceding 12 months.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	Sept. 16	2,842	— 335	16	24,741	— 278	14·4	..
Ayr	,, 19	885	— 231	18	7,063	— 25	8	..
Bath	,, 16	1,660	— 356	37	27,659	— 2,117	13	..
Belfast	,, 18	7,909	— 886	25	90,446	— 1,238	37	..
Birkenhead	,, 20	2,166	— 83	25	27,091	+ 515	19·62	..
Birmingham Corp.	,, 12	12,690	+ 177	24	150,656	+ 5,448	56·46	..
†Blackburn	,, 2	1,117	— 100	23	27,093	+ 996	14·13	..
Blackpool Corp. ..	,, 17	3,906	— 639	..	37,578	— 983	11·87	..
,, —Fleetw'd.	,, 19	2,260	— 514	11	16,110	— 1,829	8·25	..
Bolton	,, 20	4,675	— 8	25	59,479	+ 1,014	26	..
Bournemouth ..	,, 16	4,016	— 486	24	44,212	— 2,988	21·72	..
Bradford	,, 12	9,358	— 339	23	114,726	+ 598	54·9	1
Brighton	,, 20	2,102	— 160	24	25,405	+ 435	9·5	..
Bristol	,, 18	10,224	— 881	..	..	..	12·21	..
Brit. Elec. Trac. Co.								
Airdrie	,, 11	434	— 42	35	8,051	+ 35	3·65	..
Barnsley	,, 11	343	— 2	,,	6,451	+ 368	..	..
Barrow	,, 11	520	— 107	,,	9,084	— 411	5·37	..
Cavehill	,, 11	165	— 46	,,	3,374	+ 198	..	..
Devonport	,, 11	944	— 88	,,	16,791	+ 20	8·85	..
Gateshead	,, 11	2,023	— 44	,,	36,514	+ 121	11·25	..
Gravesend	,, 11	460	— 123	,,	7,777	— 1,220	6·5	..
Greenock	,, 11	1,053	— 367	,,	19,430	— 4,776	7·25	..
Hartlepool	,, 11	518	— 180	,,	8,846	— 1,821	6·72	..
Kidderminster ..	,, 11	235	— 58	,,	4,231	— 258	..	..
Leamington	,, 11	365	— 17	,,	6,197	+ 360	3	..
Merthyr	,, 11	446	+ 1	,,	7,674	+ 66	2·9	..
Metropolitan	,, 11	12,764	+1,429	,,	207,265	+38,806	22	..
Middleton	,, 11	673	— 142	,,	13,947	+ 324	8·5	..
Mid. Joint Com'tee	,, 11	11,560	— 865	,,	205,765	— 2,811	..	..
Oldham—Ashton	,, 11	1,238	— 76	,,	21,721	— 278	9·13	..
Peterborough ..	,, 11	266	— 19	,,	4,663	+ 15	5·31	..
Potteries	,, 13	3 631	— 139	,,	65,523	— 1,190	29	..
Rothesay	,, 11	625	— 248	,,	8,729	— 268	2·75	..
Sheerness	Aug. 26	148	— 19	34	1,935	— 46	..	..
Southport	Sept. 11	643	— 175	36	10,595	— 762	8·17	..
S. Metropolitan ..	,, 11	1,719	— 219	,,	29,587	+ 230	..	..
Swansea	,, 11	1,958	— 150	,,	34,402	+ 1,081	12·5	..
Taunton	Aug. 28	98	— 10	34	1,424	— 88	..	..
Tynemouth ..	Sept. 11	525	— 140	36	8,740	— 652	3·75	..
Weston-s-Mare ..	,, 9	5 2	— 173	,,	5,799	— 160	3	..
‡Worcester	,, 11	670	— 88	,,	10,354	— 48	5·75	..
Wrexham	,, 11	222	— 30	,,	3,729	— 24	..	..
Yorks. Wool. Dist.	,, 11	1,798	— 99	,,	33.276	— 1,114	17	..
Miscellaneous ..	,, 11	445	— 107	,,	7,565	— 700	..	..
Burnley	,, 19	2,447	— 321	..	..	..	7·5	..
Burton-on-Trent ..	,, 20	536	— 24	25	6,949	— 554	10	..
Bury	,, 20	2,393	— 141	24½	30,273	+ 1,696	22·5	..
Cardiff	,, 12	4,424	— 36	24	53,523	— 509	..	..
Carlisle	,, 19	370	— 14	38	6,661	— 21	..	..
Chatham and Dist.	,, 17	1,776	+ 120	37	28,787	+ 1,171	14·98	2·14
Cork	,, 17	837	— 144	37	17,186	— 644	9·89	..
Croydon	,, 18	2,818	— 296	25	36,234	— 632	11 25	..
Darlington	,, 19	411	— 31	25	5,017	— 378	..	..
Darwen	,, 18	117	— 67	41	6,399	— 108	4·96	..
Dover	,, 12	511	— 44	24	5,883	— 201	4 75	..
Dublin	,, 18	10.839	—3,768	..	67,023	—20,899	54·25	5·5
Dundee	,, 16	2,508	+ 91	17½	21,978	+ 1,312	14·5	..
East Ham	,, 19	1,789	— 147	25	21,964	— 1,902	8·43	·68
†Exeter	,, 11	872	— 2	24	7,974	— 171	5·5	..
Glasgow	,, 19	85,050	—2,510	..	272,859	— 3,987	89·5	·5
Hastings	,, 21	2,902	— 374	..	..	..	..	..
†Huddersfield ..	,, 13	1,528	— 137	24	39,197	+ 20	23·5	·5
Hull	,, 19	4,921	+ 152	25	60,301	+ 169	13	..
Ilkeston	,, 16	290	— 27	24	3,553	— 18	3·5	..
Ipswich	,, 19	916	— 48	25	10,641	— 311	10·5	..
Kilmarnock	,, 12	292	— 24	17	2,718	— 185	4·25	..
Lan'kshire Trm Co.	,, 17	2 467	— 365	37	47,964	+ 3,302	17	1·18
Lancashire United	,, 16	2,677	— 286	37	50,084	+ 2,109	39	1
Leeds	,, 12	12,903	— 831	24	161,474	+ 3,888	96·75	·25
Leicester	,, 19	4 324	— 151	..	..	..	..	..
Leith	,, 13	1,012	— 73	17½	9,711	— 24	6	..
Liverpool	,, 12	21,551	— 992	37	394,405	— 8,177	104	..
‡L.C.C.	,, 5	67,763	+4,334	..	793,707	+85,120	121½	..
London United ..	,, 19	15,189	— 611	..	253,971	+ 1,933	..	..
Lowestoft	,, 19	622	— 42	51	10,672	+ 100	3·5	..
Manchester	,, 19	80,337	—1,008	25	879,918	—10,174	89·5	11
Newcastle	,, 19	7,644	— 393	25	96,905	— 6,191	..	..
†Newport	,, 12	641	— 67	24	16,379	— 1,041	14·5	..
Northampton ..	,, 18	928	— 5	24½	11,937	..	5·5	..
Oldham	,, 20	3 744	— 305	25	51,559	+ 385	23·75	..
Pontypridd	,, 19	857	+ 291	25	9,402	+ 2,703	5	1·75
Portsmouth	,, 19	4,523	— 346	25	54,755	— 61	25	..
†Preston	,, 9	765	— 57	..	..	..	..	..
Reading	,, 17	1,280	— 39	21	15,328	+ 198	12·25	..
Rotherham	,, 17	1,239	— 53	24½	15,116	+ 49	10	·66
Salford	,, 14	8,950	— 635	24	114,324	+ 1	38·9	..
Sheffield	,, 18	10 887	— 432	24½	138,415	— 1,008	87	1·25
Southampton ..	,, 16	2,248	— 66	24	27,493	+ 1,493	..	..
Southend-on-Sea ..	,, 16	1,230	+ 56	25	12,709	+ 877	..	..
†South Shields ..	,, 12	558	— 41	..	13,918	— 296	..	..
†Swindon	,, 16	145	— 42	..	..	..	4·4	..
Tyneside	,, 16	737	— 217	11	4,331	— 590	8·87	..
Wallasey	,, 16	1,829	— 17	24½	23,323	+ 966	8·72	·22
Walthamstow ..	,, 19	1,239	— 115	25	17,113	— 859	9	..
West Ham	,, 10	4,610	— 422	24	63,894	+ 3,966	14·7	..
Wolverhampton ..	,, 16	1,568	— 108	24	20,967	— 489	12·5	..
Baker St.-Waterloo	,, 19	6,305	+1,945	12	31,620	+ 7,485	4·25	1
Cen. London Rly...	,, 19	16,696	+7,294	12	86,343	+28,764	5·77	..
Char. +, Eus. Hamp.	,, 19	6,875	+1,935	12	32,890	+ 8,895	7·75	..
City & S. Lon. Rly.	,, 20	6,165	+ 246	12	35,407	— 944	7·5	1·05
Dublin-Lucan Rly.	,, 18	308	— 8	11	1,814	— 93	7	..
G.N. and City Rly.	,, 19	2,604	— 573	12	15,494	— 3,557	3 5	..
G.N., P'dy. & Brmtn.	,, 19	10,280	+2,675	12	58,485	+12,160	9·25	·25
L'pool Overh'd Rly.	,, 20	2,711	— 200	12	17,408	— 2,606	6·8	4·3
Mersey Railway ..	,, 19	3,689	+ 160	12	23,108	+ 497	4½	..
†Metropolitan Rly.	,, 20	33,834	+3,916	12	189,024	+10,545	24·5	..
Met. District Rly...	,, 19	18 800	+4.300	12	105,976	+18,107	24	..
Anglo-Argentine ..	,, 15	60,060	+15,864	37	741,487	+122,102	43	..
‡Auckland	Aug. 14	15,571	+5,508	33½	98,150	+14,331	20·92	1·72
Bombay (B.E.T.) ..	,, 27	4,560	+ 580	34	80,313	+15,254	..	..
‡Brisbane	Aug.	17,410	+2,185	..	..	..	..	..
†Buenos A. & Belgr'o.	July 1	3,664	+ 507	26	98,075	+ 1,116	..	..
Calcutta	Sept. 19	6,468	+ 36	..	..	..	..	..
§Geneva	Aug.	9,835	+ 256	..	..	..	..	..
‡Kalgoorlie, W.A...	,,	422	..	..	30,961	..	20·5	..
Madras	Sept. 15	1,289	+ 75	37	21,093	+ 1,643	12·75	..
†Perth (W.A.) ..	,, 18	1,254	— 26	38	51,899	— 1,159	25·6	..

* Compared with the corresponding period of 1907. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

THE end of September, and of the holiday season, brings the Stock Exchange to the time of year when business should settle down into a steady volume of good trade. That is theory. How it will work out in practice remains to be seen; present indications point to a more prosperous six months than were those of the corresponding period in 1907-8. No doubt the opening of the new month next week will be a signal for more new issues to be made, in markets which do not want them.

It is complained in electrical circles that the London companies will not spend the money necessary to extend their operations and their activities. To this the natural retort of the companies is that with the L.C.C. watching for the opportunity to cut into the business, there is little temptation to attempt the raising of fresh capital, which could only be obtained upon somewhat expensive terms if the investor is to be attracted. Therefore, in this view, the companies have no choice save to mark time and watch; meanwhile, the prices of their shares gradually dwindle as the market becomes more and more restricted week by week.

Some exceptions there are, of course, to this process of shrinkage, but they are not prominent just now. London Electric Preference fell 5s. to 4¼, and here the list of alterations ends for the past week. A rise of 2 points in Bromley (Kent) Debenture stock has followed upon the declaration of the dividend, mentioned in these pages last week, on the Ordinary shares. Newcastle-on-Tyne rallied after their recent weakness.

Mexican Light and Power Common shares receded 2, to 77, the Preference drooped to 112⅜, and the 5 per cent. bonds to 91⅜, upon profit-taking induced by the recent sharp rise. The 5 per cent. bonds of the Electrical Development Company of Ontario are quoted at 86½, and the Kaministiquia Power 5 per cent. bonds stand at 95. Mexican Electric 5 per cent. bonds drooped to 90. River Plate Ordinary have slipped back to 23s. 9d., while the Preference remain at a sovereign. A steady rise in the value of Victoria Falls Power Preference shares has taken the price to 15s. Idle curiosity prompts the wonder whether all the shareholders have paid up their calls in full, plus interest. The advance in the quotation is due to sympathy with the rest of the Kaffir Market catalogue.

Home Railway stocks are generally firm to good. Even Central Londons have improved, the Ordinary and Deferred gaining a point apiece. City and South London rose ½, to 33. Metropolitan Consolidated is 1 up, but Districts eased off to 13. Notice is given of a further acceleration of the traffic on the Undergrounds, to start next week. Bakerloo Debenture stock has risen 2, to 95, Piccadilly to 93, while Charing Cross Debenture is 1½ better at 85. There are reasonable prospects of improvement still to come in the last-named stock.

With the gradual rise in these "Tube" Debenture stocks has come some inquiry for the little-known shares of the companies. None of them boast of much market, and in the case of the Charing Cross there is no quotation available in the Stock Exchange. Bakerloo Ordinary shares, however, stand at 3¼—4, the Preference being quoted at £7. Great Northern, Piccadilly and Brompton shares are called Ordinary in the pages of the Stock Exchange official list, and the price is 7¼. All these shares are of the nominal value of £10 each, fully paid, and in days to come will probably take their place with other Home Railway issues in which there is a fairly free market.

Telegraph varieties are surprisingly little altered on the week. Westerns are ¼ better, and Anglo "A" equalised by losing ⅝, and the Preferred ½. Business in this department is quiet.

National Telephone stocks are steady, but the First and Third Preference shares eased off, although the Seconds did not move. It may be observed, incidentally, that the disastrous fire in the Paris Telephone Exchange has impeded inter-Bourse business considerably in the early part of this week. American Telephone and Telegraph capital stock has further slipped back 3 points, the middle price being 131. Telegraph cable and manufacturing varieties exhibit no change beyond a fall of 10s. in Telegraph Construction shares.

The Anglo-Argentine Tramways group is strong, upon the statement issued the other day, but British Columbia Deferred is a shade weaker after its smart rise. Sellers of British Electric Traction have reduced the Ordinary to about 23s. 9d.; business was done at £1 on Monday. The Preference also are lower at £4 middle. London United Tramways Preference shed 5s.

Mexico Tramways Common stock lost 1½ to 123½, and the 5 per cent. bonds at 92⅜ are rather easier. Rio shares fell 2 to 66, while the bonds, in which a large business is being done, kept fairly firm at 90½. A rise of 7s. 6d. took United Electric Trams of Monte Video Ordinary to 6 1/16, and the Preference rose ⅛ to 5½, the Debenture stock remaining about 98½. Madras Electric Trams Debenture changed hands at 94 and 95 early in the week. Sao Paulo Tramways stock is 2 lower.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1904.	1905.	1906.	1907.	Closing Quotations Sept. 15th.	Closing Quotations Sept. 22nd.	Business done week ended Sept. 22nd, 1908. Highest	Lowest.	Rise + or Fall −	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2 — 3	2 — 3	..	..	..	Nil.
148,800	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	5 %	5 %	5 %	90 — 93	90 — 93	..	..	..	5 7 6
$131,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	7½%	8 %	8 %	132 —136	129 —133	..	..	−3	6 0 4
53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	92 — 94	92 — 94	..	..	..	4 5 1
598,180	Anglo-American Telegraph	Stock	2¾%	3½%	3½%	3½%	58 — 61	58 — 61	..	..	..	5 14 9
3,200,910	Do. do. do. 6 % Pref.	Stock	5½%	6 %	6 %	6 %	104 —105	103½—101½	105	103½	— ½	5 14 10
3,200,910	Do. do. do. Deferred	Stock	Nil	½	1¾%	1 %	17 — 17½	16⅝— 16⅞	17 1/16	16⅛	— ⅛	5 18 3
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	99 —102 xd	99 —102	..	..	..	4 16 2
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	8 — 8½	8 — 8½	..	..	..	4 14 1
2,888,376	Commercial Cable Stng. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	89 — 91	89 — 91	90½	..	..	4 7 1
16,000	Cuba Telegraph	10	10 %	10 %	10 %	10 %	7½— 8½	7½— 8½	..	..	..	7 1 2
6,000	Do. 10 % Pref.	10	5 %	5 %	5 %	6 %	15½— 16½	15½— 16½	..	..	..	5 19 5
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3 — 3½	3 — 3½	..	..	..	6 3 1
6,000	Do. do. 10 % Cum. Pref. ..	5	10%	10 %	10 %	10 %	8 — 9	8 — 9	..	..	..	5 11 1
30,000	Do. do. 4½ % Debs.	60	4½%	4½%	4½%	4½%	100 —103	100 —106	..	..	..	8 14 10
60,710£	Direct United States Cable	20	3¾%	4½%	4⅝%	4½%	131—133	131—133	13	12 13/16	..	6 3 8
50,900£	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	103	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	135½—138½	135½—138½	137½	126	..	5 8 4
2,000,000	Do. 8½ % Pref. Stock..	100	8½%	8½%	8½%	8½%	84½— 86½	84½— 86½	86	..	..	4 0 11
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	103 —105	103 —105	..	..	..	3 16 2
900,000	Eastern Extension, Australasia, and China Tele.	10	7½	7½	7½	7½	123— 131	123— 131	125½	121⅝	..	5 5 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	100½—102½	101½—103½	102	..	+1	3 17 4
262,700	East & S. Afric. Tel., 4 % Mt. Db., 1 to 8,000, red. 1909	100	4 %	4 %	4 %	4 %	99½—101½	99½—101½	..	..	..	3 18 10
200,000£	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	101½—103½	101½—103½	..	..	..	3 17 4
181,127	Globe Telegraph and Trust	10	5%	5%	5%	5%	10⅝— 11⅛	10⅝— 11⅛	10⅝	10⅜	..	5 5 8
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13⅜— 14⅜	13⅜— 14⅜	13⅜	..	..	4 4 3
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24 %	24%	20 %	20 %	28 — 30	28½— 30½	..	..	+ ½	6 11 2
19.600£	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	56 — 59	56 — 59	..	..	..	6 7 1
$41,380,400	Mackay Companies Common	$100	1 %	2 %	3½%	4 %	68 — 72 xd	68 — 72	..	..	..	5 9 7
$50,000,000	Do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	68 — 72 xd	68 — 72	..	..	..	5 9 7
384,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	⅜— ½	⅜— ½	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	4 %	5 %	6 %	6 %	1— 1⅛	1— 1⅛	..	..	..	5 6 8
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	1— 1	1— 1	..	..	+1/32	5 0 0
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	108¾—110½	108¾—110½	110	109¾	..	5 8 7
3,725,000	Do. do. Def. Stock	100	5 %	6 %	6 %	6 %	118 —120	118 —120	119	118½	..	5 0 0
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10¾— 11½	10¾— 11½	10⅞	..	— ⅛	5 6 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10½— 11⅜	10½— 11⅜	..	..	..	4 6 11
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅛— 5⅝	5⅛— 5 1/16	5⅛	..	— 1/16	4 9 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98½—100½	98½—100½	98¼	98½	..	3 7 8
1,716,598	Do. do. 4 % Deb. Stock Red... ..	100	4 %	4 %	4 %	4 %	102½—104½	102¾—104¾	103	102⅜	..	3 16 11
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	6¼%	7 %	7 %	8 %	1½— 1⅝	1½— 1⅝	26/9	..	..	5 16 4
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 1/16— 1 1/8	1 1/16— 1 1/16	..	..	..	4 11 5
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	..	4 %	4 %	4 %	89 — 92	89 — 92	..	..	..	4 7 0
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
11,889£	Reuter's	8	5 %	5 %	5 %	5 %	7½— 8½	7½— 8½	7½	..	..	5 0 0
99,100	Telephone Co. of Egypt, 4½ % Deb. Red.	100	..	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
3,083	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	129 —132	129 —132	..	..	..	4 10 11
100,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6⅜— 7⅛	6⅜— 7⅛	..	..	..	5 14 3
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	4⅜— 4⅝	4⅜— 4⅝	..	..	..	5 2 7
30,008	W. Coast of America, 1 to 30,000 & 58,001 to 58,008	2½	Nil	Nil	2½%	2½%	1⅛— 1 1/16	1⅛— 1 1/16	..	..	..	4 8 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	10	7 %	7 %	7 %	7 %	13⅜— 13⅞	13⅜— 14⅛	13⅞	13⅝	+	4 18 3
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101½—103½	101½—103½	102½	101½	..	3 17 4
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	⅜— ⅝	½— ⅝	..	..	..	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	6 %	5 %	8 %	6 %	8 — 8½	8 — 8½	8½	..	..	7 1 2
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	£2 6	8½— 9½	8½— 9½	..	..	..	2 9 0
80,000£	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

320,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,097	5	8 %	8 %	8 %	9 %	8½— 8⅝	8½— 8⅝	8⅝	8½	..	5 0 8
260,007	Do. 6 % Cum. Prefs., 1 to 260,007 ..	5	5½%	5½%	5½%	5½%	6 3/16— 6 7/16	6½— 6½	6 7/16	6⅜	+ 1/16	4 11 2
266,600	Do. Permanent, 6 % Deb. Stock, 1898	100	6 %	6 %	6 %	6 %	142 —147	143 —148	..	..	+1	4 6 11
285,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	103 —106	103 —106	103	..	..	4 14 4
880,000	Babcock & Wilcox, 1 to 880,000	1	20 %	20 %	20 %	20 %	8½— 4	8 3/16— 4 1/16	79/4½	78/1½	+ 1/16	4 18 9
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	7 %	7 %	1½— 1⅝	1½— 1⅝	54/4½	53/1½	..	3 13 10
40,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	2⅜— 2⅝	2⅜— 2⅝	80/-	..	..	12 3 6
40,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	3⅜— 4⅛	3⅜— 4⅛	..	..	..	8 9 8
20,000	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	4¼— 4½	4¼— 4½	..	..	..	6 6 4
20,000	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	5 %	3½— 4½	3½— 4½	..	..	..	4 14 1
288,200	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	5 %	106 —110	106 —110	..	..	..	4 10 11
800,000	Do. do. 5½ % Loch Leven Debs. ..	100	..	..	5½%	5½%	97 —100	97 —100	..	..	..	5 10 0
400,000	British Columbia E. Rail Def. Ord. Stock ..	100	6 %	6 %	6 %	8 %	137 —141	136 —140	..	..	−1	5 14 4
800,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	5 %	116 —120	117 —121	120½	117	+1	4 2 8
800,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	105 —109	105 —109	107½	107	..	4 11 9
383,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250 ..	40	4½%	4½%	4½%	4½%	101 —104	101 —104	102½	..	..	4 6 7
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	100½—103½	100½—103½	..	..	..	4 7 0
188,301	British Electric Traction	10	6 %	3 %	Nil	Nil	1— 1⅛	1 — 1⅛	20/-	..	— 1/16	Nil
161,427	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	3 %	3½— 4⅜	3½— 4⅜	80/-	77/6	— ⅛	7 1 2
1,473,858	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	96½— 99½	96½— 99½	98⅜	..	..	5 0 6
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	76 — 78	76 — 78	76⅝	..	..	5 15 5
100,000	British Insulated and Helsby Cables	5	8 %	8 %	10 %	10 %	6¼— 6⅝	6¼— 6⅝	..	..	..	7 8 2
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6 — 6⅛	6 — 6⅛	..	..	..	4 12 4
500,000	Do. do. 4½ % 1st Mort. Deb. Red.. ..	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
212,000	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	91 — 96	91 — 96	..	..	..	4 13 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	1/16— 2/16	⅛— ⅜	..	..	..	Nil
1,016,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	41 — 46	41 — 46	..	..	..	8 14 0
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	⅜— ½	⅜— ½	..	..	..	Nil
50,000	‡ Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,731	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	2½%	Nil	Nil	0— ⅛	0— ⅛	..	..	..	Nil
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	6 %	Nil	Nil	⅛— ⅜	⅛— ⅜	..	..	..	Nil
135,000£	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	68 — 73	68 — 73	..	..	..	6 3 3
135,000£	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	50 — 54	50 — 54	..	..	..	8 6
137,610	Calcutta Trams, 1 to 137,610	5	8 %	8 %	8 %	6 %	5½— 6	5½— 6	5⅛	5	..	5 0 0
30,000	Do. 5 % Cum. Pref., Nos. 1 to 29,330..	5	..	5 %	5 %	5 %	4¾— 5½	4¼— 6½	..	..	..	4 15 3
860,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	101 —104	102 —105	..	..	+1	4 5 9
35,000	Callender's Cable Construction shares	5	12½%	15 %	15 %	15 %	99— 102	99— 102	..	..	..	6 19 6
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5½— 5⅝	5½— 5⅝	..	..	..	5 6 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	107½—109½	107½—109½	..	..	..	4 2 2
491,222	Cape E Trams., 1 to 491,222	1	5 %	Nil	Nil	Nil	⅜— ⅝	⅜— ⅝	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	4 %	6 %	8 %	12 %	1 1/16— 1 1/8	1 1/16— 1 1/16	33/3	31/6	..	7 14 10
215,045	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4½%	103 —107	105 —107	..	..	..	4 4 1
1,898,610	Central London Railway, Ord. Stock..	Stock	4 %	4 %	4 %	3 %	67 — 69	68 — 70	69½	67½	..	4 6 11
558,195	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	84 — 86	84 — 86	..	..	..	4 13 0
558,195	Do. do. Def. do.	Stock	4 %	4 %	4 %	2 %	48 — 51	49 — 52	51⅝	48¾	..	3 18 5
1,480,000	City and South London Railway	Stock	2¼%	1½%	2½%	2½%	32 — 33	32½— 33½	32⅝	32¾	+ ½	6 6 10

* Unless otherwise stated, all shares are fully paid. † A period of nine months. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Sept. 15th.	Closing Quotations Sept. 22nd.	Business done week ended Sept. 22nd, 1908.		Rise + or Fall —	esent Yield per cent.
		*	1904.	1905.	1906.	1907.			Highest	Lowest.		£ s. d.
85,000	Crompton & Co., Nos. 1 to 85,000	S	2½%	2½%	5 %	5 %	1 5/16 — 1 9/16	1 5/16 — 1 9/16	..	..	..	9 10 6
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	96 — 99	98 —101	100	99	+2	4 19 0
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1½ — 1¾	1½ — 1¾	..	..	..	6 13 4
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 15/16 — 1 15/16	1 15/16 — 1 15/16	..	..	..	4 11 5
282,580	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 1 to 60,000	10	6 %	6%	6 %	6¼%	11¼ — 12½	11½ — 12½	..	..	..	5 4 0
59,967	Do. 6 % Pref. between 1 and 60,000	10	6 %	6 %	6 %	6 %	12½ — 13½	12½ — 13½	..	..	..	4 8 11
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,961	5	2½%	4½%	4½%	4½%	3/4 — 7/8	3/4 — 7/8	..	..	..	16 12 6
17,189	Do. "A" shares, 01—017,189	5	2½%	4½%	4½%	4½%	1½ — 2¼	1½ — 2¼	..	..	..	8 6 9
319,475	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	76 — 79	76 — 79	..	..	..	5 1 3
72,220	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	85 — 87	85 — 87½	..	..	..	5 14 11
112,100	Electric Construction, 1 to 112,100	2	4 %	Nil	Nil	Nil	3/8 — 5/8	3/8 — 5/8	..	..	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890	2	7 %	7 %	7 %	7 %	1 1/16 — 1¼	1 1/16 — 1	..	..	..	Nil
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	7½ — 8	7½ — 8	..	..	..	6 5 0
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	86 — 90	86 — 90	..	..	..	4 8 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	4 %	¾%	½ — 1	¾ — 1¼	..	..	..	5 0 0
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10½ — 10¾	10½ — 10	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103½	..	..	..	4 17 1
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15%	15 %	15%	10½ — 11½	10½ — 11⅜	11	..	..	8 18 10
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5½	5 — 5	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	107 — 109	107 —109	107½	..	..	4 2 7
50,000	India-Rubber, Gutta-percha & Telegraph Works.	10	5 %	10%	10 %	10 %	15½ — 16½	15½ — 16½	16⅜	16⅛	..	6 1 8
87,500	†Liverpool Overhead Railway, Ord.	10	1¾%	Nil	Nil	¾%	1½ — 1¾	1½ — 1¾	..	..	..	4 0 0
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	5½ — 6	5 — 5½	..	..	— ½	9 1 10
600,070	London United Trams. (1901), 1 to 50,007	10	6 %	3 %	3 %	3 %	6½ — 6¾	6¼ — 6½	..	..	..	4 8 11
399,930	Do. do. 50,008 to 100,000	10	6 %	3 %	3 %	3 %	6½ — 6¾	6¼ — 6½	..	..	..	4 8 11
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	5 %	5½ — 6½	5⅝ — 6½	5⅞	5½	— ¼	8 0 0
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	75 — 80	75 — 80	..	..	..	5 0 0
5,782,062	Metropolitan Consolidated	100	3 %	2¾%	1 %	¾%	36 — 37	37 — 38	38	36½	+1	1 6 4
2,640,914	Do. Surplus Lands	100	2¾%	2¾%	2¾%	2¾%	66 — 68	66 — 68	67½	66	..	4 0 11
3,285,000	Do. District	100	Nil	Nil	Nil	Nil	13 — 14	12½ — 13½	13½	12¾	— ½	Nil
314,016	Metropolitan Electric Trams., Defd.	1	Nil	Nil	Nil	Nil	1/16 — 3/16	3/16 — 5/16	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1/16 — 3/16	3/16 — 5/16	..	..	— 1/16	6 13 4
350,000	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	92 — 95	92 — 95	..	..	..	4 14 9
245,500	Potteries E. Tro.	1	5 %	4 %	4 %	4 %	1/16 — 3/16	1/16 — 3/16	..	..	..	8 0 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	3/16 — 5/16	3/16 — 5/16	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	93 — 96	92 — 95	94	..	—1	4 14 9
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	15 %	17½%	32½ — 34½	32 — 34	..	..	— ½	6 18 8
150,000‡	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
3,599,200	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts.	..	5 %	5 %	5 %	5 %	39 — 43	42 — 46	43½	41½	+3	10 17 4
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	1	Nil	Nil	Nil	10 %	3/8 — 1½	3/8 — 1½	..	..	..	8 0 0
66,666	Do. 6 % C.P., 30,001 to 80,000 & 126,001 to 141,666	5	Nil	Nil	..	6 %	2½ — 3	2½ — 3	56/8	55/-	..	10 0 0
46,404	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	72 — 76	72 — 76	..	..	..	5 5 3

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000	5	5⅓%	5⅓%	5⅓%	5⅓%	4⅛ — 5	4⅛ — 5	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	94 — 97	96 — 99	..	..	+2	4 10 11
30,131	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10%	10 %	6⅞ — 7⅜	6⅞ — 7⅜	..	..	..	6 9 0
9,869	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	6¾ — 7¼	6¾ — 7¼	..	..	..	4 13 4
336,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 — 102	99 —102	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply	5	8 %	5 %	5 %	5 %	3½ — 4	3¾ — 4	..	..	..	6 5 0
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4 — 4⅛	4 — 4⅛	81/3	..	..	5 0 0
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3¾ — 4	3¾ — 4	..	..	..	5 12 6
445,786	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	94½ — 96½	96 — 99	96	95	..	4 10 11
49,486	Chelsea Electricity Supply, Ord.	5	6 %	6 %	4½%	4½%	2⅞ — 3⅛ xd	2⅞ — 3⅛	61/3	..	+2½	6 8 7
175,000‡	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	9⅝ — 10⅛	9½ — 10⅛	9⅝	..	..	5 17 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12 — 13	12 — 13	12⅛	..	..	4 12 4
400,000‡	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	122 —125	122 —125	..	..	..	4 0 0
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
40,000	County of Durham Electrical Power, Ord.	5	£3 7 0	4 %	4 %	2 %	2¼ — 3	2¼ — 3	..	..	..	3 6 8
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	3¾ — 4½	3¾ — 4½	..	..	..	5 17 8
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4½%	5 %	5 %	5 %	7¼ — 8¼	7¼ — 8¼	7⅜	..	..	5 17 8
40,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅜ — 10⅝	10⅜ — 10⅝	10 9/16	10 7/16	..	5 10 4
400,000‡	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	107 —110	107 —110	108	107½	..	4 10
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	99 —102	99 —102	100⅛	100	..	4 8 3
80,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	4 %	Nil	Nil	1/16 — 3/16	1/16 — 3/16	4/6	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	3 %	Nil	¾ — 1	¾ — 1	1s/6	15/-	..	Nil
488,000	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	59 — 66	59 — 66	..	..	..	16 4
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅜ — 5⅛	4⅜ — 5⅛	98/9	..	..	5 4 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	..	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 — 100	..	..	..	4 10 11
15,000	Hove, 1 to 18,000	5	8½%	9 %	9 %	8½%	6 — 6½	6 — 6½	6⅜	..	..	6 10 9
21,000	Kensington and Knightsbridge Electric Ord.	5	12 %	10 %	10 %	10 %	7⅜ — 8⅛	7⅜ — 8⅛	..	..	..	5 14 3
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 2 6
10,000	London Electric Supply Corporation, Limited, Ord.	3	3 %	4 %	4 %	2½%	⅞ — 1⅛	⅞ — 1⅛	..	..	..	5 8 1
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	6 %	4⅛ — 4⅜	4⅛ — 4⅜	..	..	— ⅛	6 9 9
74,395	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	4½%	89 — 92	89 — 92	..	..	..	4 17 10
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	10 %	8 %	6¼%	4⅛ — 4⅜	4⅛ — 4⅜	93/9	..	..	6 16 10
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅛ — 5	4⅛ — 5	91/3	..	..	4 12 4
220,000‡	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	105 —109	105 —109	..	..	..	4 2 7
250,000‡	Do. 5% % Mort. Deben. Stock Redem.	Stock	5½%	5½%	5½%	3½%	84 — 89	84 — 89	..	..	..	3 18 8
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	94 — 97	94 — 97	..	..	..	4 12 9
87,500	Newcastle-on-Tyne, 1 to 87,500	5	8 %	8 %	8 %	8 %	5⅛ — 5⅝	5⅛ — 5⅝	..	..	+ ⅛	7 19 2
87,500	Do. 5 % Pref., 1 to 87,500	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 6 11
10,853	Notting Hill Electric Lighting	10	7 %	7½%	7½%	7½%	11⅞ — 12⅜	11⅞ — 12⅜	..	..	..	5 17 8
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	7 %	5⅝ — 6⅛	5⅝ — 6⅛	..	..	..	5 14 3
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 99	95 — 98	..	..	..	4 1 8
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	12½%	10 %	10 %	7 — 8	7 — 8	..	..	..	6 5 0
20,000	Do. do. 7 % Pref. 20,001 to 40,000	5	7 %	7 %	7 %	7 %	6¾ — 7¼	6¾ — 7¼	..	..	..	4 16 7
150,000‡	Do. do. 3½ % Deb. Stock Red.	100	3½%	3 %	3½%	3½%	86 — 90	86 — 90	..	..	..	3 17 9
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	4 %	Nil	Nil	1/16 — 3/16	1/16 — 3/16	..	..	..	Nil
80,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	68 — 72	68 — 72	..	..	..	5 11 1
65,000	South London Electricity Supply, Ord.	5	4 %	4 %	3 %	4 %	2⅜ — 2⅞	2⅜ — 2⅞	..	..	..	6 19 2
120,000	South Met. Elec. Lt. & Power, Ord.	1	Nil	2½%	2½%	2½%	3/16 — 5/16	3/16 — 5/16	..	..	..	4 0 0
117,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 1/16 — 1 3/16	1 1/16 — 1 3/16	10/-	..	..	5 12 0
200,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	102	..	..	4 7 5
20,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	¾ — 1	¾ — 1	..	..	..	20 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1 1/16 — 1 3/16	1 1/16 — 1 3/16	..	..	..	10 10 6
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	82 — 85	82 — 85	..	..	..	5 5 11
110,000	Westminster Electric Supply, Ord.	5	14 %	18 %	12 %	10 %	7⅛ — 8⅛	7⅛ — 8⅛	..	..	..	5 17 8
81,279	Do. do. 4½ % Cum. Pref. (Original 5 %—Red. to 4½ % from 31st Dec., 1906)	5	5 %	5 %	4½%	4½%	5 — 5⅛	5 — 5⅛	..	..	..	4 1 10

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. ‡ Interim Dividend.

Bank rate of Discount 2½ per cent., May 28th, 1908.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING AUGUST, 1908.

While trade in general may be dull, British exporters of electrical material, at least, can congratulate themselves on flourishing times.

In connection with the July returns, we referred to that month's export business as constituting a record, the value being £211,087; that figure, however, is exceeded by the August total of £223,591—a total which exceeds the 1907 monthly average by approximately £56,000.

The imports, on the other hand, only represent £145,422 value, as compared with £164,162 in July, and are some £10,000 below the 1907 average; and the re-exports are similarly placed, showing a considerable falling off, the August value being £11,851, as compared with £17,899 in the previous month.

The phenomenal value of the exports is largely made up by £91,903 worth of electrical machinery and £79,987 worth of cables which figure in this month's returns; it may also be interesting to record that Russia alone took some £32,000 worth of cable.

As regards the imports to this country, it is interesting to note that the £40,506 worth of lamps constitutes the largest individual section, Germany alone contributing some £26,000 value of lamps to this total.

No particular interest attaches to the other classes of imports, as they are generally below the usual average, the value of the machinery imports being less than half that of the preceding month.

Due to extensive cable purchases, Russia and its Scandinavian neighbours were our leading customers during August, Japan and India following.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.*

Country receiving exports and importing.	Electrical goods and appliances.	Electrical cable.	Electric lighting fittings and accessories.	Electric lamps.	Electric meters and instruments.	Electric machinery.	Batteries and accumulators.	Carbons.	Telegraph and telephone material, and electric bells.	Electrically-driven machinery.	Tramway apparatus and materials.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	227	32,519	108	61	298	910	51	5	73	20	...	34,272
Germany	150	1,872	30	67	24	324	10	...	...	...	...	2,477
Netherlands	314	876	...	...	30	254	20	...	...	...	...	1,494
Belgium	160	244	...	4	271	162	2	...	511	5	...	1,359
France and French Indo-China	94	10	55	567	9	755	35	...	62	...	...	1,587
Portugal, Madeira and Portuguese Africa ...	235	683	10	91	45	188	8	...	207	...	...	1,467
Spain and Canary Isles	107	1,021	11	11	46	4,249	...	...	4	...	...	5,449
Italy and Austria-Hungary	177	131	48	106	281	4,033	...	33	...	...	...	4,809
Greece and Turkey	111	26	800	26	...	1,094	9	...	...	...	...	2,066
Channel Isles, Gibraltar and Malta	574	24	51	23	86	212	...	...	12	...	...	982
U.S.A. and Cuba	117	...	101	130	...	...	...	...	...	...	...	348
Canada and Newfoundland	352	4,092	205	33	16	608	82	...	237	...	...	5,625
British West Indies, Brit. Honduras, Falkland Islands and British Guiana	20	...	25	3	...	54	3	...	105	...	...	210
Mexico, Nicaragua, Venezuela, Colombia and Panama	45	...	...	36	...	579	...	...	...	...	...	660
Peru and Uruguay	59	98	...	...	...	308	...	...	122	...	...	587
Chile	33	11	200	535	264	1,774	208	...	23	...	...	3,048
Brazil	338	718	218	253	192	1,750	94	50	...	...	...	3,613
Argentine	3,098	1,460	64	123	390	6,388	2,898	...	411	...	...	14,832
Egypt	403	1,870	323	271	113	423	18	6	51	336	...	3,814
British West Africa and St. Helena ...	37	55	208	6	...	322	199	...	170	...	...	997
Cape of Good Hope	400	136	124	118	124	2,143	4	2	...	...	...	3,051
Natal	980	457	99	352	132	4,896	21	22	...	...	...	6,959
Zanzibar, British East Africa, Mauritius and Uganda	45	30	...	...	...	115	7	...	24	...	...	221
China and Siam	457	2,359	282	238	650	3,315	95	23	...	11	...	7,430
Japan	314	3,355	23	34	1,147	27,645	122	...	267	...	...	32,907
Java and Dutch Indies	55	...	1,125	...	...	1,790	...	...	...	...	...	2,970
India...	2,313	2,074	1,844	678	897	12,061	420	99	111	948	...	21,445
Burmah	282	419	119	74	...	178	...	...	24	...	...	1,096
Ceylon	19	14	103	26	...	100	54	...	30	5	...	351
Straits Settlements and Fed. Malay States and Sarawak	108	2,764	789	77	85	298	35	27	81	108	...	4,372
Hong Kong	173	630	129	458	...	758	...	9	9	...	...	2,166
West Australia	316	16	12	53	34	364	44	57	...	...	...	896
South Australia	671	7,973	498	8	...	863	3,808	...	...	...	...	13,821
Victoria	781	6,794	65	435	544	200	131	...	50	...	...	9,000
New South Wales	1,256	5,114	52	1,285	...	5,045	238	251	666	...	...	13,907
Queensland	250	9	58	268	...	164	...	...	33	...	...	782
Tasmania	3	656	...	...	...	198	6	...	97	...	...	960
New Zealand	1,034	1,477	80	175	1,229	7,383	112	22	49	...	...	11,561
Total, £	16,108	79,987	7,859	6,625	6,907	91,903	8,734	606	3,429	1,433	...	223,591

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

	£	£	£	£	£	£	£	£	£	£	£	£
Norway, Sweden and Denmark	3	199	...	156	...	726	428	84	3,346	...	...	4,942
Germany	1,279	12,316	393	26,211	33	12,821	764	2,161	1,523	...	...	59,501
Holland	188	4,411	779	9,118	1,854	2,299	140	6,188	343	10	...	25,330
Belgium	803	7,429	556	2,566	407	2,635	217	1,068	10,813	56	...	26,550
France	...	1,603	122	1,708	1,813	1,515	1,226	2,323	191	20	...	10,521
United States	4,625	517	1,470	747	...	10,498	227	36	411	1,676	...	20,207
Total, £	6,898	26,475	3,320	40,506	4,107	30,494	3,002	11,860	16,627	1,762	...	145,051

Additional Imports: Italy, machinery, £90; Canada, electric lamps, £281.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

	£	£	£	£	£	£	£	£	£	£	£	£
Various countries, mainly as above	2,054	1,269	64	2,027	...	2,434	267	410	3,326	...	...	...

Total Exports: £223,591. Total Re-Exports: £11,851. Total Imports: £145,422.

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified; the latter, doubtless, consisting of similar materials to those appearing in adjacent columns.

* This section does not include telegraph cables and apparatus.

GERMANY'S EXPORTS OF ELECTRICAL GOODS DURING THE FIRST HALF OF 1908.

The following statement showing the quantity of electrical goods of various kinds exported from Germany during the six months ended June 30th, 1908, is taken from the recently issued official statistics; the figures for the corresponding period of 1907 have been given for purposes of comparison, increases and decreases being shown:—

		In double centners (220·4 lb.) 1907.	1908.	Increase or decrease.
Dynamos, Motors, Converters, Transformers and Choking Coils, up to 5 Double Centners weight.—				
To	Austria-Hungary ...	3,800	3,600	— 200
„	Great Britain ...	1,500	2,000	+ 500
„	Belgium	1,100	1,500	+ 400
„	Italy	4,500	6,600	+ 2,100
„	Netherlands ...	1,100	1,300	+ 200
„	Russia in Europe ...	1,400	1,100	— 300
„	Spain	1,200	1,300	+ 100
„	Other countries ...	8,200	9,400	+ 1,200
	Total	22,800	26,800	+ 4,000
Ditto, over 5 Double Centners in weight.—				
To	France	2,300	5,900	+ 3,600
„	Switzerland ...	1.300	1,500	+ 200
„	Netherlands ...	2,700	3,600	+ 900
„	Belgium	6,700	10,400	+ 3,700
„	Great Britain ...	6,300	12,000	+ 5,700
„	Austria-Hungary ...	4,800	5,100	+ 300
„	Italy	9,200	20,500	+ 11,300
„	Russia in Europe ...	1,400	3,600	+ 2,200
„	Norway	5,300	2,500	— 2,800
„	Spain	4,000	7,200	+ 3,200
„	Argentina	4,400	6,300	+ 1,900
„	Japan	1,300	4,000	+ 2,700
„	Brit. S. Africa ...	500	3,800	+ 3,300
„	Other countries ...	4,800	21,600	+ 16,800
	Total	65,000	108,000	+ 43,000
Rotors and Commutators.—				
To	Great Britain ...	2,300	2,000	— 300
„	Austria-Hungary ...	2,000	1,300	— 700
„	Italy	1,500	2,100	+ 600
„	Russia in Europe ...	600	1,600	+ 1,000
„	Other countries ...	4,600	5,000	+ 400
	Total	11,000	12,000	+ 1,000
Accumulators and Plates, without horn or rubber, &c.—				
To	Denmark	2,700	2,100	— 600
„	Netherlands ...	1,900	900	— 1,000
„	Sweden	1,800	6,900	+ 5,100
„	Argentine	600	2,200	+ 1,600
„	Other countries ...	9,000	4,900	— 4,100
	Total	16,000	17,000	+ 1,000
Cable.—				
To	Netherlands ...	11,000	12,500	+ 1,500
„	Belgium	16,200	19,800	+ 3,600
„	Great Britain ...	25,000	16,300	— 8,700
„	Denmark	7,600	10,300	+ 2,700
„	Sweden	11,200	17,900	+ 6,700
„	Spain	6,100	4,200	— 1,900
„	Argentina	19,800	12,700	— 7,100
„	Japan	4,200	4,800	+ 600
„	Uruguay	7,300	3,200	— 4,100
„	Italy	4,300	3,900	— 400
„	Norway	3,400	5,300	+ 900
„	Other countries ...	27,000	50,900	+ 23,900
	Total	135,400	152,600	+ 17,200
Arc Lamps.—				
To	Belgium	340	240	— 100
„	Russia in Europe...	300	290	— 10
„	Great Britain ...	400	380	— 20
„	Argentina	300	300	—
„	Other countries ...	1,960	1,790	— 170
	Total	3,300	3,000	— 300
Incandescent Lamps.—				
To	Austria-Hungary...	180	250	+ 70
„	Italy	170	400	+ 270
„	Great Britain ...	410	1,400	+ 990
„	France	400	300	— 100
„	Russia in Europe...	300	360	+ 60
„	Other countries ...	1,340	1,890	+ 550
	Total	2,800	4,600	+ 1,800
Telegraph and Telephone Material.—				
To	France	400	370	— 30
„	Great Britain ...	870	1,300	+ 430
„	Italy	500	740	+ 240
„	Austria-Hungary ...	250	300	+ 50
„	Switzerland ...	380	390	+ 10
„	Belgium	730	680	— 50
„	Netherlands ...	360	420	+ 60
„	Russia in Europe...	690	640	— 50
„	Denmark	340	370	+ 30
„	Other countries ...	2,080	1,990	— 90
	Total	6,600	7,200	+ 600
Electrical Apparatus for Lighting, Power, &c.—				
To	Belgium	1,400	2,700	+ 1,300
„	Great Britain ...	2,100	3,400	+ 1,300
„	Netherlands ...	980	1,550	+ 570
„	Spain	1,460	1,700	+ 240
„	Switzerland ...	1,050	1,300	+ 250
„	Italy	3,000	3,900	+ 900
„	Austria-Hungary ...	2,100	3,100	+ 1,000
„	Russia in Europe...	1,800	2,500	+ 700
„	Sweden	1,200	2,500	+ 1,300
„	Argentine	1,900	2,600	+ 700
„	Chile	800	1,500	+ 700
„	Japan	240	1,260	+ 1,020
„	Uruguay	800	1,200	+ 400
„	Other countries ...	5,270	7,690	+ 2,420
	Total	24,100	36,900	+ 12,800
Electrical Measuring and Recording Instruments.—				
To	Great Britain ...	300	220	— 80
„	Italy	600	680	+ 80
„	Austria-Hungary ...	900	770	— 130
„	Switzerland ...	460	250	— 210
„	Denmark	230	180	— 50
„	Sweden	300	410	+ 110
„	Russia in Europe...	390	390	—
„	Spain	270	320	+ 50
„	Argentine	260	190	— 70
„	Other countries ...	890	1,290	+ 400
	Total	4,600	4,700	+ 100
Carbons, Brushes, &c.—				
To	France	1,100	1,200	+ 100
„	Switzerland ...	1,300	1,100	— 200
„	Austria-Hungary ...	1,300	1,500	+ 200
„	United States ...	4,100	2,500	— 1,600
„	Great Britain ...	5,300	6,100	+ 800
„	Italy	2,400	2,500	+ 100
„	Other countries ...	5,900	8,200	+ 2,300
	Total	21,400	23,100	+ 1,700

SWITCH AND TRANSFORMER OIL.—III.

By "GLUCKAUF."

Oil Cooling and Transformer Cases.—Owing to the fact that oil is a very much better heat-conducting medium than air, the output for a given size of oil transformer is naturally larger than the output of the same size of air-cooled transformer. The temperature rise of an oil-cooled tranformer being largely influenced by the cooling surface of its case, it is only natural that the amount of oil per kilowatt should vary with different makers. About 1·75 gallons per kilowatt is probably as low as it is safe to go, the modern tendency of all makers being to considerably increase the oil case capacity. Present practice allows about 2 to 3 gallons per kilowatt, except in the very large sizes (1,000 KW. and over), where water-cooling pipes are usually provided, or in some cases special cooling fans, when water is not available. The "Berry" transformers, made by the British Electric Transformer Co., have vertical oil-cooling pipes fixed round the outside of the oil case; some makers employ special radiators, which in mining work are frequently placed in the air-way, so as to be exposed to as much draught as possible. When water-cooling pipes are used they must, as already stated, be so placed that condensation moisture is not allowed to mix with the oil; and further, no joint whatever should be placed inside the oil case, as water leakage, be it ever so slight, would very seriously lower the dielectric

strength of the oil. A 1,000-KW. transformer will require about 150 gallons of cooling water per hour. Under 500 KW., the natural circulation of the heated oil is sufficient, no water cooling being necessary.

The great trouble with the oil cases is the difficulty in keeping joints oil-tight, as the oil will creep through the ordinary riveted joint, and, of course, jointing material or cement is useless, as it is rapidly dissolved by the hot oil.

Sheet-steel is generally preferred for the cases, owing to the thin walls readily allowing the heat to be dissipated, and the steel is, as a rule, corrugated to secure extra strength. The sheet-steel sides are taken to the foundry, and the base cast on, thus making a sound oil-tight joint. This method is usually satisfactory, although blow holes round the joint that cannot be seen at the time, may ultimately develop into leaky places. Riveted joints must be very thoroughly caulked; in some cases, special soft metal caulking strips are riveted in with the joint. For oil pipe joints, soft lead jointing rings are the most satisfactory, but if any considerable pressure has to be provided for, one pipe edge should be turned with a flat face, and the other with a sharp V-shaped edge. The two are then forced into metallic contact by a right and left-handed coupling piece. This latter joint is expensive, but absolutely oil-tight even under very considerable pressure. It is a good plan to smear all coupling threads with boiled linseed oil when fitting together. Linseed oil expands on drying, and is not redissolved by mineral oil provided it once gets dry, so that good low-pressure oil joints can be made in this way, using, of course, well-cut threads.

Much of the trouble with oil pipe leakage is traceable to the use of cheap pipe screwing tackle and bad workmanship.

A substantial transformer case base, so designed that it can be readily handled without putting any strain on the sides and joints, will tend to very considerably reduce the risk of leaky joints being developed. The use of special deposit collecting pockets, so arranged that any deposit is not disturbed by oil circulating currents, is also advisable.

Inflammability and Fire Risks.—Insulation oils are not, as frequently supposed, very inflammable. No oil will take fire until its temperature is raised up to the burning point, which, for transformer and switch oil, is about 200° C., a temperature that would never be reached under any but the most unusual circumstances. Even then, the supply of air being shut off by the transformer case, the actual fire risk is very small. Naturally no fibrous, cotton, or other porous material not actually submerged, should be allowed to become saturated with oil so as to act as a wick. Even ordinary paraffin will extinguish a ball of burning cotton waste provided this is plunged below the surface; and if, during repair or soldering operations, the insulation of a transformer takes fire, the best thing to do is to lower it promptly down into the oil tank, when the oil will readily put out the flames.

In the event of a fault developing in the windings and causing serious local heating, the increased oil circulation is, as a rule, sufficient to prevent any serious oil temperature rise taking place before the cut-outs have time to operate, the self-healing nature of the oil insulation tending to suppress any arcing. Under such conditions, the fire risk is very small, the smoke trouble being far more serious, especially in mining work. On the other hand, a fault in an air transformer may give rise to most dangerous arcing, especially in a mining transformer. It is possible to render even the light oils, such as paraffin, non-inflammable by so treating them that the atoms of hydrogen are replaced by chlorine. This is hardly likely to be ever used for transformer oil, but may possibly be of value in the case of oil-cooled resistances subject to heavy loads. Where fan or other form of forced cooling is used, it is important that any failure or stoppage of the fan motor should be immediately visible to the attendant, otherwise a serious rise of oil temperature would, of course, take place.

Oil Switches.—The absence of electric oscillations when an oil switch opens circuit, especially if the circuit contains any considerable amount of capacity or of self-induction, is now so well recognised that, for high-tension work, the air-break switch may be regarded as a thing of the past, as air-break switches may produce most dangerous pressure rises. Mr. Duddell has clearly shown that while, with an air-break switch, the pressure rise on switching out a given cable was 2·7 times the normal working voltage, the same cable when switched off by means of an "oil-break" with contacts under oil, showed no pressure rise at all. The oil switch has the valuable property of always breaking the circuit when the current wave is passing through its zero value, which is precisely the condition under which the pressure rise is a minimum. The current is not instantaneously interrupted, but a non-inductive resistance in the shape of a hydrogen gas bubble is introduced into the circuit at the break. Owing to the oil being incompressible, the gas bubble remains under very considerable pressure until the current is interrupted when passing through its zero value. The arc is not always broken at the first time the current passes its zero value, but appears to be maintained for a few current waves, the gas bubble tending meanwhile to increase in size and to considerably increase as regards its pressure until the arc is finally supressed, while the current is passing through its zero value.

Cailletet found that with air at a pressure of 40 to 50 atmospheres, he was unable to get a powerful induction coil to spark across a gap of only 0·05 cm., approx. 0·019 in.

Unlike resonance phenomena, these pressure rises are independent of the wave shape of the impressed E.M.F. and of frequency, but are due to changes in the circuit and to the period in the current wave at which these changes, such as switching on and off, are made. The most dangerous pressure rises are those due to a short circuit of low resistance taking place in air at ordinary pressure. Transformers, such as instrument transformers, with their secondary closed through a low resistance undoubtedly tend to reduce any pressure rise taking place when the cables are switched on, but it is very doubtful if they tend to prevent those pressure rises that take place on opening circuit. From what has been said regarding the action of the oil switch, it is evident that a very light oil would not sufficiently confine the hydrogen bubble, and would, therefore, allow the arc to be displaced. On the other hand, an abnormally viscous oil would not be sufficiently self-healing to quickly drown the arc, and further would tend to prevent the switch blades making good contact, thus resulting in heating of the contacts. The undesirability of forming an arc in air is one of the great objections to the horn type arrester, and especially to the roller type arresters such as the "Wurtz," both of which undoubtedly give rise to oscillations. It has been frequently observed that breakdowns of instrument-transformers, &c., have taken place some considerable time (15 to 20, or even 30 minutes) after the occurrence of a short, and the operation of the excess pressure arresters.

Probably the arresters themselves set up high frequency oscillations which, owing to their frequency, were not able to puncture the insulation, but ultimately succeeded in doing so as the frequency decreased.

Hence the use of oil-immersed dischargers so as to avoid the objectionable arcing in air would obviously be very desirable, but up to the present this form of arrester does not appear to have been successful. Mr. W. B. Woodhouse some years ago experimented on these lines. With multiple air-gaps or horns in series, the oscillations produced are quite serious, especially if any capacity is connected across the spark-gaps, such as cables, &c. Some experiments made by the writer, in which a capacity was connected across a multiple spark-gap, clearly showed most alarming high-frequency oscillations; unfortunately, lack of facilities prevented very full investigations being made.

Oil Switch Cases.—As a certain amount of carbon is set free every time the switch operates, it is necessary that the oil should be removed and filtered periodically. It is therefore desirable that the oil tank should be easily removable without disturbing the switch connections. As already pointed out, the cases must be quite dust and moisture proof, all leading-in connections being provided with proper dust and moisture-proof bushings. Very many oil switches are by no means dust and damp-proof, and consequently give trouble.

Oil Storage.—It is of very little use for the manufacturer to take trouble to thoroughly clean and dry the oil, unless the customer takes due precautions to see that it is properly stored. If stored in barrels, these must be kept under cover and not, as too frequently is the case, left standing in the

open with the barrel heads covered with water. Metal drums are far more satisfactory, as a considerable amount of moisture can soak through the wooden barrels, whereas the metal drums are, of course, absolutely damp-tight. Transformer cases and oil-switch cases must be quite clean and free from any moisture before being filled up, every care being taken to prevent moisture from reaching the oil after filling the cases. Unless care is taken to dry thoroughly the cotton insulation, quite an appreciable amount of moisture will be carried into the oil by the insulation. Many breakdowns are undoubtedly due to this neglect. The additional slight expense of well cleaning and drying windings, &c., is amply repaid by the corresponding increase of safety from breakdown, as 1 per cent. of moisture will quite ruin the dielectric strength of the best oil. The average workman will not realise this point, so that most careful supervision is absolutely essential. It is an excellent plan to heat up the oil to about 120° C. (248° F.) and to fill up the cases while it is warm.

THE OBSOLESCENCE OF ELECTRIC LIGHTING PLANT.

By F. FERNIE.

In order to arrive at the proper annual contribution to a reserve fund which a municipality should make on account of its electricity supply scheme, it would appear preferable to divide the sum into two parts: One part to cover actual wear—depreciation—and one part as a contribution to an insurance fund against obsolescence or antiquation. The former part may be arrived at with some degree of accuracy by estimating the lives of the different components of the plant. If the lives of any be estimated to be less than the period for which the money has been borrowed, a fund must be formed, which shall at the end of the life of this particular portion of the plant, be equal to the original capital cost of the plant, less the amount of the capital charge already paid back, and less the scrap value of the plant.

The amount of the obsolescence fund is much more obscure. The plant may never be obsolete until the whole of the original capital cost has been repaid, or it may be entirely obsolete six months after erection. In the former case an obsolescence fund would never be drawn on, and in the latter case there would be no fund to draw on.

1. A manufacturer's plant may not be obsolete unless the saving effected per annum by the adoption of newer machinery is equal to the annual interest, depreciation and sinking fund on the additional outlay for the new machinery.

2. But he may, by acquiring a new machine, be able to sell his articles at a lower rate, so that while with his present amount of business the equation above would not be satisfied, he may yet be able to foresee such an increase of business produced by the lower rate as will satisfy the equation. In this case his present plant would be antiquated.

3. Again, a trade rival may, by acquiring the new machines and selling at a proportional price, force manufacturer No. 1 to scrap his present plant, although the equation above is not satisfied.

4. A firm's clients may demand an article that can only be made by some new machine, and in this case, again, his old plant may be rendered obsolete. Apply these cases to the manufacture and sale of electrical energy.

1. In this case, the need of an obsolescence fund is not clearly apparent, since the saving would be so great that, with the same number of consumers, the existing price could be maintained, with the same financial result.

Obviously, if there were an obsolescence fund to draw on, the price could be lowered, still without altering the financial result.

2. The object of any municipal electrical scheme is to supply energy to the greatest possible number, and therefore at the lowest possible rate. Hence any machinery which will cheapen production should be adopted as early as possible. The possibility of adopting such machinery will be hastened by the existence of an obsolescence fund.

It may be said that, while the existence of this fund lowers the price, and therefore increases the number of consumers *after* the year in which it is spent, it acts in a reverse way during the years in which it is being built up.

The annual contributions would, however, be relatively so small as hardly to affect any consumers, especially small ones.

3. This is the case where the existence of an obsolescence fund is most clearly seen to be necessary.

Whilst many electricity supply schemes have a monopoly of the sale of *electrical* energy, they have no monopoly of the sale of *energy*, and, indeed, in nearly every case they meet with severe competition in their business.

The price of some rival form of energy might be considerably lowered, but electrical plant would not be rendered obsolete, unless there were more efficient plant in the market to install. Also, the invention of more efficient means of producing, distributing, or consuming electrical energy (where a monopoly for the sale of electrical energy is held) does not necessarily imply the antiquation of existing plant.

To ensure antiquation (by competition) there must be an improved efficiency possible, in the production, &c., of electrical as well as of the *rival* form of energy.

4. Electrical plant might be rendered obsolete under this heading by improved consuming devices; for example, by the invention of a new form of lamp requiring some special voltage, or a motor demanding, say, two-phase alternating current.

Judging from past experience, it seems probable that the obsolescence of modern electrical supply plant will come about very gradually. It is likely to be brought about by an accumulation of small improvements rather than by brilliant inventions.

The introduction of wireless telegraphy is an example. Although the advent of wireless telegraphy was fairly sudden, and the scrapping of submarine cables prophesied in the immediate future, it is, nevertheless, likely to be many years before submarine cables are really obsolete.

Taking this point of view, then, *the risk* of any plant becoming obsolete will be least at first and will gradually increase as time goes on; so that the chance of obsolescence is greatest at the end of the plant's life. This may be represented on a diagram as a straight line, starting from zero and attaining its maximum value at a period equal to that for which the money to pay for the plant was borrowed. (See A B, fig. 1.)

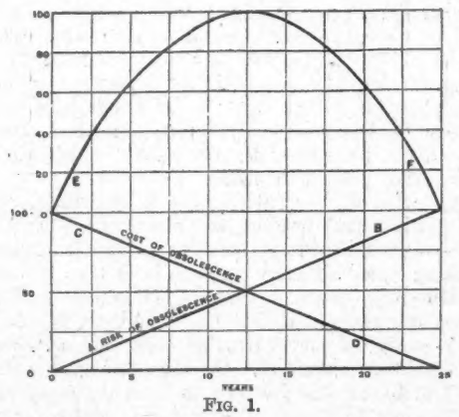


Fig. 1.

Now *the cost* to the owners, if the plant becomes obsolete, will be greatest first, when none of the money is repaid, and will decrease with time, becoming zero at the end of the period for which the money was borrowed—*i.e.*, when it has all been repaid. Thus *the cost* of obsolescence may be represented on the same diagram as *the risk* by a straight line,*

* The assumption is made here that the "cost" and the "risk" of obsolescence are related in some way.

It may be doubted if the risk or expectation of antiquation is rightly represented by a straight line, which denotes an equal chance or a probability of one-half.

which starts at its maximum value and decreases to zero at the end of the loan period. (Fig. 1, C D.)

The writer suggests that if the values of the ordinates of these two lines be multiplied together at every point, the resulting curve (E F) represents, to some scale, the relative annual contributions which should be made to the obsolescence fund. This curve starts at zero, rises to a maximum at half time and then decreases to zero again. The combined chance and cost of obsolescence is thus a maximum at half the period for which the money has been borrowed.

Whether the scale of contributions to the fund be rigidly adhered to throughout the whole of the loan period or not, depends on the amount of obsolescence that occurs—*i.e.*, on whether the money is spent or not. Thus if at half time none of the money has been spent, and there appears no immediate prospect of having to spend any of it, it would seem unnecessary further to increase the fund.

Those parts of the plant which have an estimated life of less than the loan period, although provided for by the other half of the fund, have yet to be provided for in the obsolescence fund, but having a shorter life, to a less extent than the longer-lived portions of the plant. For instance, if part of the plant had an estimated life of 15 years only, the maximum contribution to provide for its obsolescence should be at the seventh or eighth year of its life, whilst if the estimated life of the remainder of the plant were 25 years (the loan period) the maximum contribution would be in the 12th or 13th year.

There arises, then, the question, to what scale the curve E F should be drawn. To get at this, the whole of the capital expenditure might be divided into three parts :—

1. That portion of the plant with an estimated life of less than the loan period.

2. That portion of the plant with a life estimated equal to, or greater than, the loan period.

3. A portion of the capital expenditure represented by assets which are exceedingly unlikely ever to become obsolete.

Under No. 3 could, perhaps, be included the cost of obtaining a provisional order, and land and buildings.

Separate curves can be drawn for No. 1 and No. 2. To fix the scale of these curves some assumption must be

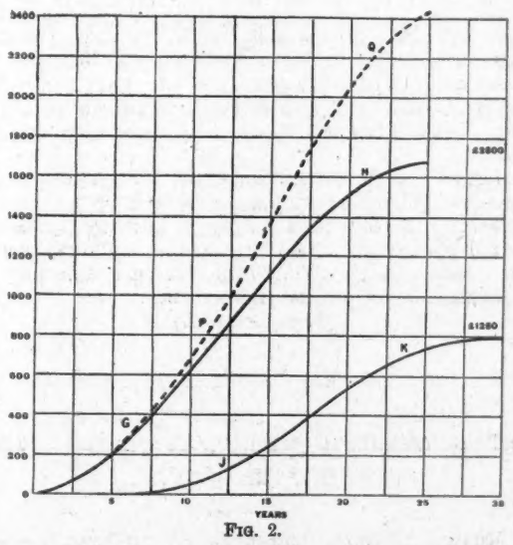


Fig. 2.

made. Suppose it is assumed that one-half the plant (coming under heading No. 2) will have to be replaced owing to obsolescence before the end of the loan period. The obsolescence fund is, of course, not intended to entirely replace antiquated plant, but only to make up the difference between the cost of the new plant and the amount of the loan on the old plant already repaid.

A further assumption is thus necessary, the *time* at which the plant will become antiquated. Assume that of the amount likely to become antiquated (one-half of the whole of No. 2) one-half requires replacing at half the loan period, and one-half at three-fourths of the loan period. If the capital cost of the plant under No. 2 heading is £10,000—

Half is estimated to become antiquated	= £5,000
Half of this is obsolete at half the loan period (25 years)	= £2,500
Half of this sum has been repaid, leaving half to be made up from the obsolescence fund	= £1,250
A further £2,500 is required at three-fourths of the loan period.	
Three-fourths of this has been repaid...	= £1,875
Leaving one-fourth to be made up from the obsolescence fund	= £625

A curve can be drawn above the curve E F, showing the *growth* of the fund; the scale of this curve must then be such that, at 12½ years, the fund = £1,250 (fig. 2, G H).

If it be £1,250 at half-time, it cannot be £625 at three-quarter time, but will be greater, if the contributions follow the curve E F.

Hence the assumptions made above are not consistent with the curve E F.

The curve E F assumes that the replacement of plant due to obsolescence will not take place in two lumps, but will take place gradually, something each year. However, some such assumptions are good enough to base the scale of the curve G H upon. The shape of the second half of the curve may, of course, be greatly modified by what has happened during the first period.

The probable scrap value ought also to be taken into account, but this will be estimated to be very small, except in the case of cables, and particularly drawn-in cables. Copper will probably always have a considerable value, apart from its use in the distribution of electrical energy. The very possible invention of some new form of storage battery might have a considerable effect on some networks. The curves shown are for the original capital outlay ; in practice this is continually being added to, so that the curves would have to be redrawn at intervals of two or three years.

This could be done by drawing a new curve (J K) for the new capital expenditure. J K and G H would then be added together, making the curve G P Q. This curve could be used for, perhaps, from the fifth to the tenth year, when it would be again modified, and so on.

STEAM TRAPS.

By GORDON STEWART.

(*Continued from page* 453.)

Perhaps no individual steam trap of the expansion type has received such a vast amount of patronage as has that bearing the name of Mr. Wm. Geipel—its designer. Its principle and construction are both extremely simple. For the sake of those to whom the device is not familiar, I would explain that the principle of differential expansions is employed in a strikingly ingenious manner by arranging the two expansion members so as to form the two sides of an isosceles triangle. The geometrical properties of the isosceles which are utilised are :—That the two expansion members so situated as to form the two equal sides, if anchored at their base and allowed to expand at their apex, produce a motion at that apex proportionate to the difference of expansion of the two members, which motion takes place practically at right angles to the direction of the lineal expansion, where the base of the triangle is relatively small. An additional feature is that the smaller the base the greater is the amount of movement, for a given difference of temperature. These features being incorporated in the design render the trap exceedingly compact. The expansion members in the Geipel trap are of brass and iron ; the lower pipe being of brass, forms the inlet to the valve, and the upper, or iron pipe, the outlet. For the purpose of considering the action of the trap, we will imagine that it has been properly adjusted and set to drain the water of condensation from a steam kettle ; and, further, that a discharge has just taken place, the valve being hard up into its seating. Immediately water reaches the brass inlet pipe in a sufficient quantity to reduce its temperature a few degrees, the resultant contraction will have the effect of causing a depression of the apex of the isosceles triangle ; so that the

valve will open and allow the water to pass. Steam following up behind this water almost instantaneously, causes the brass tube to expand again and close the valve. In connection with the opening of this discharge valve it is interesting to notice that instead of the valve being removed from its seating, as one generally imagines a valve to open, the seating is removed from the valve. When properly adjusted, this trap is remarkably free from dribbling; but, in common with traps of the expansion type, it is not suitable for use under circumstances entailing very great fluctuations of pressure. However, there is a special pressure compensating device which may be fitted and employed under such conditions.

Mr. Geipel's latest type is known as "The Rapidity" Geipel steam trap. Whilst embodying all the up-to-date improvements in its design, its principle is identical with that of a standard Geipel. The arrangement of the various parts differs to some extent; for instance, the converse positions of the brass and iron pipes are employed, and the shape of the valve box is much altered, it being so arranged that the valve is held on to its seat by the steam pressure, which, as will be noticed, is also the converse of that of the earlier type.

It is a noticeable feature in connection with the discharge from a steam trap, that should the pressure in the system under drainage be somewhat high the discharge is of a very violent nature, and the first thought which would naturally occur to an observer is that the discharge capacity is very much handicapped by an apparent throttling action taking place at the valve. This action in some cases is the cause of a noisy discharge, and one which would exert a deleterious cutting action upon the valve face and seat. The type of Geipel trap under consideration is designed to get over these difficulties. In the first place, by so arranging the valve that it is held on to its face by the steam pressure, it was found possible to employ a greater discharge valve area without imposing great strain upon the trap; and further, the noise and cutting action have been reduced to a minimum by so arranging that, independently of the amount, the discharge is

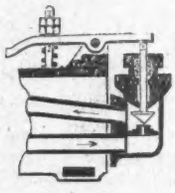


Fig. 1.

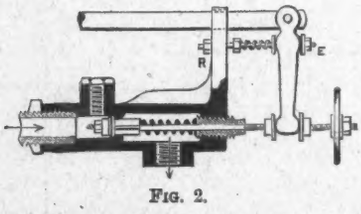


Fig. 2.

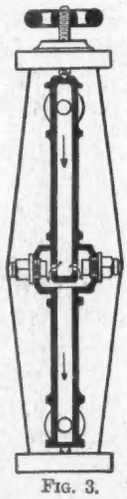


Fig. 3.

controlled when under a high pressure, but free to occupy the full bore of the valve when at a low pressure. This action is obtained by the introduction of a loose spring-controlled sleeve on the discharge side of the valve. This sleeve is acted upon by the discharge, and is so arranged that the momentum of the water as it rushes past is sufficient at high pressures to lift it slightly, and consequently reduce the effective area of the discharge, and thereby reduce its velocity. Since the height to which the sleeve would be lifted depends upon the momentum of the discharge, it is obvious that this throttling device can be set so as to come into action only at high pressures.

Another expansion trap having several interesting and original points for consideration is that designed and patented by Mr. Wm. Granger. A section through the valve box is shown in fig. 2. This is the trap, previously referred to as containing the nickel-steel member, which, owing to its extremely low coefficient of expansion, may be employed with advantage. The trap consists of a brass tube having an inlet connection at one end and a valve box, valve, &c., at the other. Parallel to this tube is a solid nickel-steel rod, the overall length of which, for all practical purposes, is constant; so that the total expansion or contraction of the brass tube may be fully utilised. The amount of expansion of a brass tube of reasonable length being, comparatively speaking, very small, it is desirable that some means be adopted to multiply the amount of expansion at the valve. This is obtained by a single lever transmission, as seen in fig. 2, by which means the actual expansion is multiplied about five times at the valve seat.

A point of interest is the manner in which the trap is relieved of a great deal of the strain set up when working under comparatively high pressure. Immediately behind the valve, which is held on to its seat by the steam pressure in the system under drainage, is placed a spring; this has the effect of counteracting fully two-thirds of the pressure on the back of the valve, which, if not relieved, would subject the multiplying lever and its support to a very great strain, for under certain conditions it might otherwise be as much as 500 lb. It should be noticed that this is relieved without in any way impairing the discharge capacity of the trap.

A very simple type of expansion trap is that manufactured by Messrs. Royles, a section being shown in fig. 3; other traps of this class are manufactured by Messrs. Holden and Brooke, Messrs. Ogdens, Messrs. Watson & McDaniel, of Philadelphia, and the Reliance Engineering Co.

As expansion steam traps depend for their successful working entirely upon difference of temperature, and as also the temperature of steam varies with the pressure, it is obvious that they are not suitable for use under circumstances subjecting them to very great fluctuations of pressure, without requiring continual readjustment. They may, however, be fitted with special pressure compensating devices to enable them automatically to adjust themselves to a fluctuating pressure. This is a very important consideration in connection with Admiralty work, where the boiler pressure is liable to fluctuate within very wide limits in a short interval of time. Mr. Geipel has arranged for this in his trap by utilising, in place of the hand adjustment, an automatic device dependent for its action upon the steam pressure acting upon a diaphragm and collar; this arrangement automatically adjusts the position of the valve relative to that of the box. This type is known as the "Admiralty" Geipel, and is much used by our own and foreign Admiralties.

Mr. Granger's device consists of a small cylinder and piston; the motion of the latter, being controlled by the steam pressure, rotates the stud R E, fig. 2, and thereby adjusts the position of the valve relative to the expansion tube, timing the discharge to take place earlier or later, according as to whether the pressure has risen or fallen.

(*To be concluded.*)

INTERNATIONAL TRAMWAYS AND LIGHT RAILWAYS UNION.

Munich Meeting, September 6th to 12th, 1908.

The large attendances at the meetings up to the official closing, and their composition of delegates from all parts of the world, showed that both the subjects for consideration, and the place where these legions met, were well chosen.

Though great praise is due to the Council and secretary of the Union for the excellent programme, and for the thoroughness with which every detail had been prepared, they were outdone by the lavishness with which Munich discharged its duties as host. The convictions of the delegates did not conform to unanimously accepted formulæ upon many subjects, but as far as hospitality and entertainment were concerned, there was only one voice.

The papers, which were unfortunately not only presented, but also read at the meetings, dealt with many subjects—brakes, corrugation of rails, gear wheels, lubrication, Bavaria's wealth of water power, motor-'buses, and energy meters—but few of these subjects were exhaustively treated, and the value of the work done will be found rather in the impulses given for further research, and in the wealth of data presented, than in concrete results.

The brake question was doubtless the most important dealt with, but unfortunately also one with which manufacturing interests were largely connected. These may be held responsible for harm done to the prestige of the "Union Internationale" by the vote passed on this question—even as it was, by a small and doubtful majority.

To justify this qualification it should be said that several speakers showed just before the vote was taken that they were mistaken about the motion. Moreover, there was not only a large number of members present who possessed no votes, but also guests, and even if none of these voted, the number of hands raised was so small that the vote cannot be considered representative of the opinion of the bulk of the members.

The resolution carried practically amounts to a declaration that the rheostatic brake is a perfectly satisfactory brake for heavy cars, steep gradients, and high speeds, and that there is no need for anything better unless excessively heavy cars or trains with more than three trailers and speeds above 18 M.P.H. are concerned. There is no need of criticising this resolution, as the use of the rheostatic brake is restricted in Great Britain to that of a last resource after all other means have failed.

But it can easily be shown that German tramway managers would do well to reconsider this question.

While the highest premiums paid by British tramways to insurance companies amount to barely 2 per cent. on the gross revenue, German tramways had to pay about 8 per cent. until they arranged for mutual insurance, and even this brought the premium down only to about 4 per cent. If it is taken into consideration that German tramway lines contain probably a several times higher percentage of level roads than British lines, that their rails are only on rare occasions coated, and then merely with a suspicion of mud, while many of the British lines are "greasy" 11 months out of 12, the suggestion is not out of place that better brakes would probably enable German tramways to pay considerably higher dividends than they do at present. We should be greatly surprised if any of the better known power brakes could swallow even 1 per cent. of the gross revenue.

The pneumatic brake was graciously admitted to be as efficient as the electric. The obvious purpose of this rider was to meet any demand on the part of public authorities for the introduction of air brakes with the "resolution" of the Congress, which proves that an equally good brake—viz., the rheostatic, is already on the cars.

The subject of corrugation of rails was broadly dealt with by Herr A. Busse, of the Grosse Berliner Strassenbahn, whose paper contained numerous and interesting illustrations. He attributed this serious and rapidly increasing evil to the following causes :—

1. To the material of the rails, which was good enough for lighter cars and slower speeds, but which are not of uniform quality and frequently unable to withstand the strains now imposed. He suggests both etching tests and careful calibration of rails.
2. Too hard tires.
3. Rapid braking while travelling at high speeds. This is due to rapidly acting brakes. Drivers should be instructed accordingly. (With regard to this suggestion, it should be noted that rheostatic brakes are probably the worst offenders.)
4. Excessively rapid starting. (Drivers whose cars are provided with current meters are said to be specially partial to this weakness.)
5. High-speed travelling. Cars rock and "sling" severely when travelling at high speeds, and act then like rapid hammers.
6. "Slinging" of the cars, caused through—
(*a*) Rigid connection of the two wheels and their axle.
(*b*) Uneven diameters of the two wheels.
(*c*) Differences in the levels of the two rails.
(*d*) Uneven loads.
(*e*) Differences in the elasticity of the springs of the same vehicle.
(*f*) Play in the axle bearings.
(*g*) Uneven rail gauge.
(*h*) Longitudinal unevenness of rails.
(*i*) Advancing of the directly-driven wheel as compared with the other wheel.
(*k*) Non-parallel axles.
(*l*) Defective trucks.
(*m*) Too short wheel base.
7. Curves with large radii.

The outer wheels advance in a jerky fashion when the cars travel at high speeds through these curves. Through small curves they are bound to travel slowly.

8. Rigidity of the track.

Corrugation of rails of the Berlin city lines and of the conductor rails on the Vienna tramway conduits seems to prove this. The rails and conductors respectively which are the more solidly bedded show severe corrugations.

Grinding and milling of the rails so affected is recommended, and three types of machines for this purpose are illustrated.

(We are afraid that worse evils would be produced by interfering with the solid bedding of rails, which has been laid down at great expense.)

Of the many causes mentioned, the uneven loading of wheels, assisted by faulty wheel gauge, faulty rail gauge and unequal levels of the two rails, are probably the most fruitful ones, and those which could be removed at smallest expense.

Whatever tends to induce one wheel to advance or lag behind the other is bound to assist corrugation. The heavier loaded wheel is sure to bite better than the light one, and uneven gauge increases this tendency.

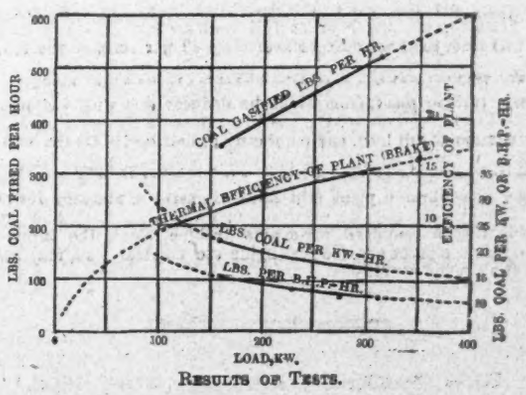
It is also clear that the heavier the load on the wheel concerned the more destruction of the rail will it effect every time it advances or lags.

An interesting experience, but one which was not too pleasing to some of the ladies, was presented on the excursion to Schloss Herrn Chiemsee, when the train was pulled by one of the new express engines of the Bavarian State Railways. A speed of over 75 miles was maintained for a considerable part of the journey, but 90 miles per hour was exceeded for a short period.

The electrical members of the meeting were greatly indebted to Commerzienrath Thomas, who conducted them through his brewery, which is a most modern and, at any rate, from the point of view of an engineer, a leading establishment. Electric motors are largely used for driving auxiliary machines, and the party were unanimous in declaring that they never tasted better beer than these motors helped to produce.

ELECTRIC POWER GENERATION BY GAS ENGINES.

In view of the great interest which has recently been taken in the performance of gas engines of large size in connection with the driving of electric generators, as evidenced, among other things, by the excellent tours on the Continent organised by the Key Co., it is perhaps unfortunate that actual data regarding the performance of such engines under actual working conditions are not more freely available. The reading of a paper by Mr. J. R. Bibbins


LBS. COAL FIRED PER HOUR
EFFICIENCY OF PLANT
LBS. COAL PER KW. OR B.H.P.-HR.
COAL GASIFIED LBS PER HR.
THERMAL EFFICIENCY OF PLANT (BRAKE)
LBS. COAL PER KW.-HR.
LBS. PER B.H.P.-HR.
LOAD, KW.

Results of Tests.

before the annual convention of the American Institution of Electrical Engineers at Atlantic City, in July last, and reported in the *Western Electrician*, on a series of tests of gas-electric power plant, is therefore of considerable interest, and we reproduce the main features of the tests and the results obtained.

Measurements were taken, extending over a period of 30 days, on the service plant of the Richmond Works of the American Locomotive Co., consisting of a 23·5 in. × 33 in. horizontal tandem gas engine, with a direct-connected direct-current generator operated on producer gas, generated by two 9-ft. bituminous pro-

ducers. A 15,000 cb. ft. holder equalises the quality of the gas, and provides sufficient storage to start the engine and its motor-driven auxiliaries.

The engine is of the double-acting type, giving two impulses per revolution, governed by a sensitive oil-relay system. The ratio of air to gas is constant, except when the gas itself changes. Duplicate igniters work together from motor-generator and lighting mains respectively. The producer is designed for continuous operation, generates its own steam, and the plant requires for auxiliaries a motor-driven fan, tar extractor, and igniter set. The diversity factor of the works is good, and the plant is called on for continuous 24-hour service, except on Sundays and holidays. The following table gives the general results of the test:—

TABLE I.—General Results of Test.

	Full load.	¾ load.	½ load.
Length of run, hours	223	125	136
Average load, KW.	312·3	228·3	159·6
Average load, computed boiler H.P.	455·0	333·0	338 0
Load, per cent. engine rating ...	91·0	67 6	47·5
Load, per cent. generator rating ...	104·0	77 2	53·2
Coal gasified, lbs.	115,289	54,143	47,775
Coal gasified, per hour	517·0	433·0	351·0
Output, KW.-hours	69,650	28,540	21,710
Pounds coal per KW.-hour	1·654	1·697	2·20
Lb. coal per KW.-hour, guaranteed	1·93	2·10	2·64
Lb. coal per boiler H.P.-hour ...	1·14	1·31	1·56
Average heat value of coal, B TH.U....	14,392	14,392	14,392
B.TH.U. per KW.-hour...	23.700	27,280	31,650
B.TH.U. per boiler H.P.-hour... ...	16,415	18,710	21,670
Per cent. thermal efficiency, brake...	15·51	13·6	11·75
Per cent. thermal efficiency, electric	14·35	12 65	10·78

Coal.—Pocahontas run-of-mine; average heat value dry sample, 14,703, as fired, 14,392; volatile matter 22 8 per cent., ash 4·5 per cent., sulphur 1 per cent.

Test.—August 12th, 7 a.m., to September 7th, 12 m.

The results were also plotted in the form of three curves, showing the plant economy at various loads, the first giving the rate of gasification in pounds per hour, the second the pounds per unit generated per hour, and the third the corresponding thermal efficiency. With a 400-KW. load, which is within the limits of this plant, the coal consumption would be roughly 1·5 lb. per KW.-hour, or 1·0 lb. per boiler horse-power-hour. It will be seen by producing the line of total coal gasified back to the datum line that it requires over one-third the full-load coal to run the plant unloaded. Neglecting this constant loss, the plant can operate at the rate of 1 lb. of coal per KW.-hour—a constant value at all loads. The standing loss of the producer plant during Sundays and holidays averaged 46 lb. per hour, or 2·5 per cent. of the weekly coal consumption. The plant has sustained a load of 410 KW. for three hours, 19 per cent. overload on the engines, and even higher loads for short periods. With rich gas the power of the engine was of course correspondingly increased.

The results of the tests were used to calculate the cost of power supplied by the plant based on a 300-day operation, or 7,200 hours per year, distributing the fixed costs only over the operating period, and not over the entire year, but including standing losses and power-consumption charges. The power costs were estimated at full and half load respectively, as an industrial plant has an averagely uniform load throughout the day. With fuel at $2 20 cents per ton, power can be delivered at the switchboard at 2/3 cent. per KW.-hour at full load, or less than 1·25 cents at half load, the fixed charges averaging 40 per cent. of the total cost.

Mr. Bibbins makes a comparison of this plant with an equivalent steam turbine plant, from which he deduces that with the price of coal mentioned above, the gas plant shows a 13 per cent. gain over steam at full load, and 5 per cent. at half load. On the other hand, with light loads or fluctuating loads averaging only a fraction of the generating capacity, the gas plant is at a disadvantage. The turbine plant still finds exclusive application for all loads subject to extreme overloads and variations, and it is probable that a combined gas-engine turbine plant, the turbines carrying the peaks and the gas engine the uniform load, may best meet all-round conditions.

NEW PATENTS APPLIED FOR, 1908.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

18,709. "Improvements relating to time switches for electric circuits." F. Barron. September 7th.

18,713. "Improvements in or relating to electric traction on the surface contact system." The S.P. (Suchostawer Patents) Syndicate, Ltd., and H. M. Rayner. September 7th. (Complete.)

18,715. "Improvements in or relating to the regulation of alternating current generators working in parallel." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H., Germany.) September 7th. (Complete.)

18,721. "Improvements in dry battery cells." W. S. Doe. September 7th. (Complete.)

18,755. "Magneto-electric ignition apparatus." A. Zahringer. (Date applied for under Rule 13, March 30th, 1908. An invention comprised in application No. 7,014, dated March 30th, 1908.) September 7th. (Complete.)

18,756. "Magneto-electric ignition apparatus." A. Zahringer. (Date applied for under Rule 13, March 30th, 1908. An invention comprised in application No. 7,014, dated March 30th, 1908.) September 7th. (Complete.)

18,766. "Improvements in and relating to electric heating devices." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) September 7th.

18,767. "Improvements in the electric-deposition of iron." S. O. Cowper-Coles. September 7th.

18,811. "Improvements in double effect sparking coils." E. Denieport. September 8th. (Complete.)

18,822. "Improvements in point shifting arrangements for electric tramways and the like." J. P. Tierney and J. Malone. (Application for Patent of Addition to No. 19,923/08.) September 8th.

18,832. "Improvements in or relating to arc electric lamps." H. Liske and A. Zoller. September 8th. (Complete.)

18,855. "Improvements in or relating to magnetic separators." H. Alcock and H. C. Simpson. September 8th. (Complete.)

18,880. "Improvements in and relating to the manufacture of magnetos." H. Stephens. September 8th. (Complete.)

18,893. "Improvements in the insulation of conductors of electricity." H. G. Longford. September 9th.

18,897. "Improvements in the manufacture of candles, brushes, plates, blocks and diaphragms for electrical purposes." E. Breadner and G. A. Crighton. September 9th.

18,900. "Improvements relating to electric lampholders." A. Bates. September 9th.

18,905. "Improvements in and connected with telephone indexes." F. O. Watson and H. Eaton. September 9th. (Complete.)

18,915. "Improved electrical system of railway signalling." G. A. Cook and C. M. MacNamara. September 9th.

18,917. "Completely de-energising dangerous overhead wires the moment they snap." D. P. F. Ghadiali. September 9th.

18,925. "Method and apparatus for adjusting electrical resistances." O. Cox. September 9th.

18,946. "Process for manufacturing metal filaments of refractory metals, wolfram, molybdenum, uranium, tantalum and the like or mixtures thereof." W. Heinrich. September 9th.

18,965. "Improvements in starting switches for electric motors." E. Garside. September 9th.

18,996. "Improvements in electric signalling on railways." G. H. Brown. September 10th.

19,007. "Sanitary telephone cap." G. D. Cooper. September 10th.

19,052. "Supports for filaments of incandescent electric lamps." F. R. Pope and M. W. O'Connell. September 10th. (Complete.)

19,054. "Improvements in control systems for electrically-propelled vehicles." H. L. Beach. (Date applied for under Sec. 91 of the Act, September 26th, 1907, being date of application in United States.) September 10th. (Complete.)

19,096. "Improvement of billiard light pendant." F. Kissel. September 11th.

19,097. "Improvements in drums or reels for coiling, and transporting electric cables, wire, ropes and the like." T. Hosking. September 11th.

19,101. "Instantaneous electric press-button push." J. B. Wintour. September 11th.

19,107. "Improved electrically-heated curling tongs and goffering irons." H. W. O. Taylor. September 11th.

19,109. "Improvements in electrically-operated valve-controlling devices." J. Keith and C. Tuson. September 11th. (Complete.)

19,115. "Improvements in or connected with devices for making and breaking electric contacts." F. H. Varley. September 11th.

19,118. "Process for the manufacture of oxide-coated metal holders for electrical show lamps with metal filaments." T. McKenna. (Gluhlampenwerk Anker G.m.b.H., Germany). September 11th. (Complete.)

19,141. "Improvements relating to electric flashing signs." L. K. Job. September 11th.

19,150. "Improvements in or relating to electric light fittings." A. T. Woodhall and A. Emery. September 11th.

19,151. "Improvements in and relating to time switches." W. Vetter and C. Murer. September 11th.

19,169. "Process for packing metal filaments for glow lamps." Gluhlampenwerk Anker G.m.b.H. (Date applied for under Sec. 91 of the Act, September 12th, 1907, being date of application in Germany.) September 12th. (Complete.)

19,183. "Improvement in or applicable to electroliers and gasoliers." R. S. Woods. September 12th.

19,188. "Improvements relating to mantles for gas and electric lighting and heating." W. G. Potter. September 12th.

19,194. "Improvements in plugs or connectors for electrical machines." H. J. Fisher. September 12th.

19,201. "Sparking plugs for internal combustion engines." A. Hanl and O. Waldau. (Date applied for under Sec. 91 of the Act, September 13th, 1907, being date of application in Germany.) September 12th. (Complete.)

19,205. "Improvements concerning the construction of electrodes for primary and secondary batteries." E. Schultz. September 12th.

19,223. "New or improved automatic voltage control." H. Leitner September 12th.

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Internal-Combustion Engine with Magneto Igniter for Actuating Cycles and the like. C. A. Allison. (Soc. Anon. H. & A. Dufaux & Cie, Switzerland.) 5,264. March 9th.

Arc Lamps. Allgemeine Elektricitäts Ges. 9,502. May 1st. (Date applied for under International Convention, May 2nd, 1907.)

Insulators for Telegraph Wires and the like. G. Pollock and W. E. Werd. 10,211. May 11th. (Date applied for under International Convention, May 9th, 1907.)

Electrical Contacts. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 11,511. May 27th.

Transmitters for Electrical Signalling Systems. F. Koch. 12,265. June 5th. (Date applied for under International Convention, June 6th, 1907.)

Electric Cut-Out. G. Gaglio and L. Villani. 12,678. June 12th.

Mode of and Apparatus for Electrically Sounding a Horn. A. H. Nicholson. 14,579. July 9th.